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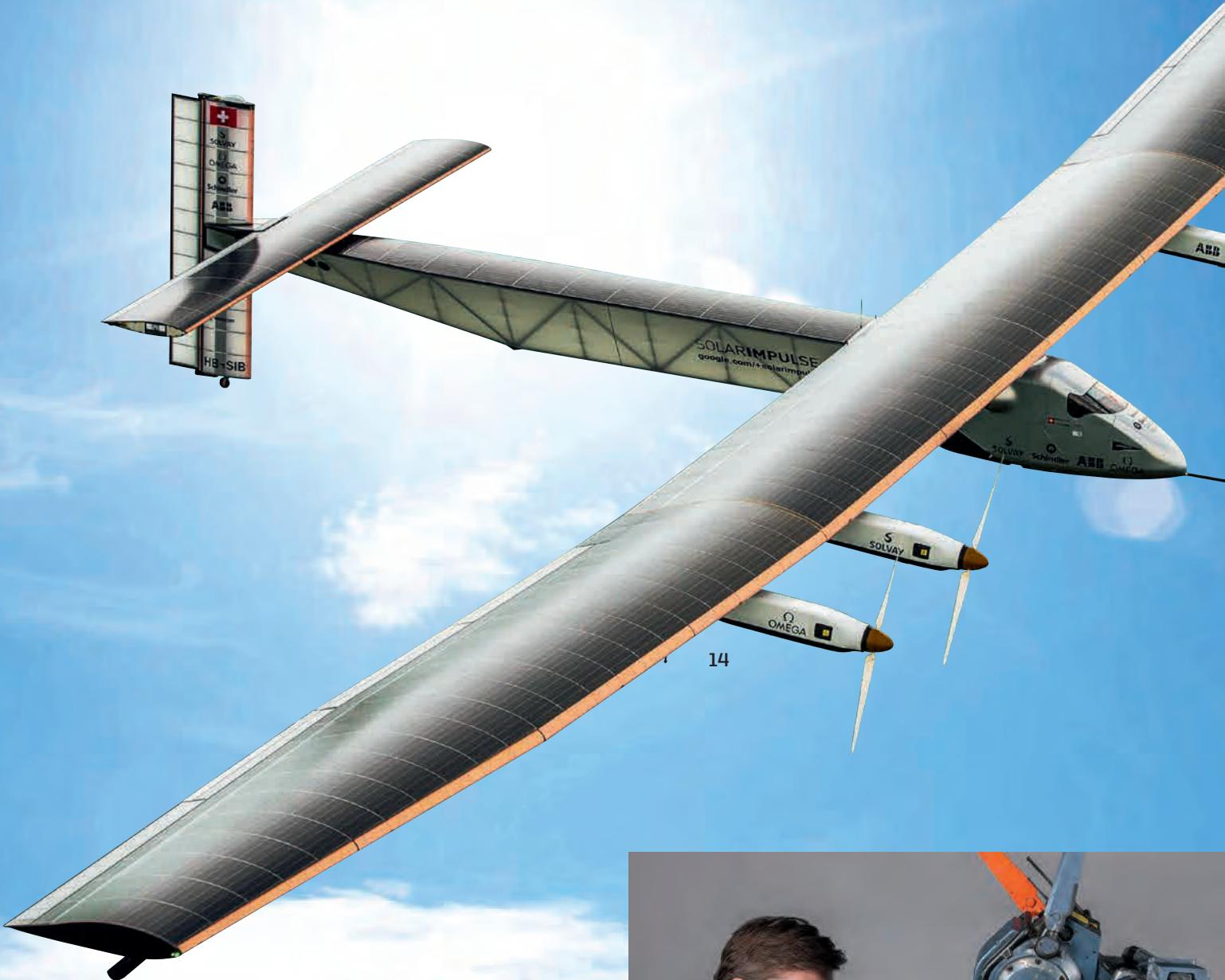


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Cover caption: Artificial intelligence, robots and the new Neill Blomkamp movie *Chappie* are intertwined in our cover story, which includes an exclusive interview with the human who is also Chappie, Sharlto Copley. This page: Swiss pilots Bertrand Piccard and André Borschberg were due to attempt to become the first people to circumnavigate the world in a solar-powered aircraft, Solar Impulse 2.



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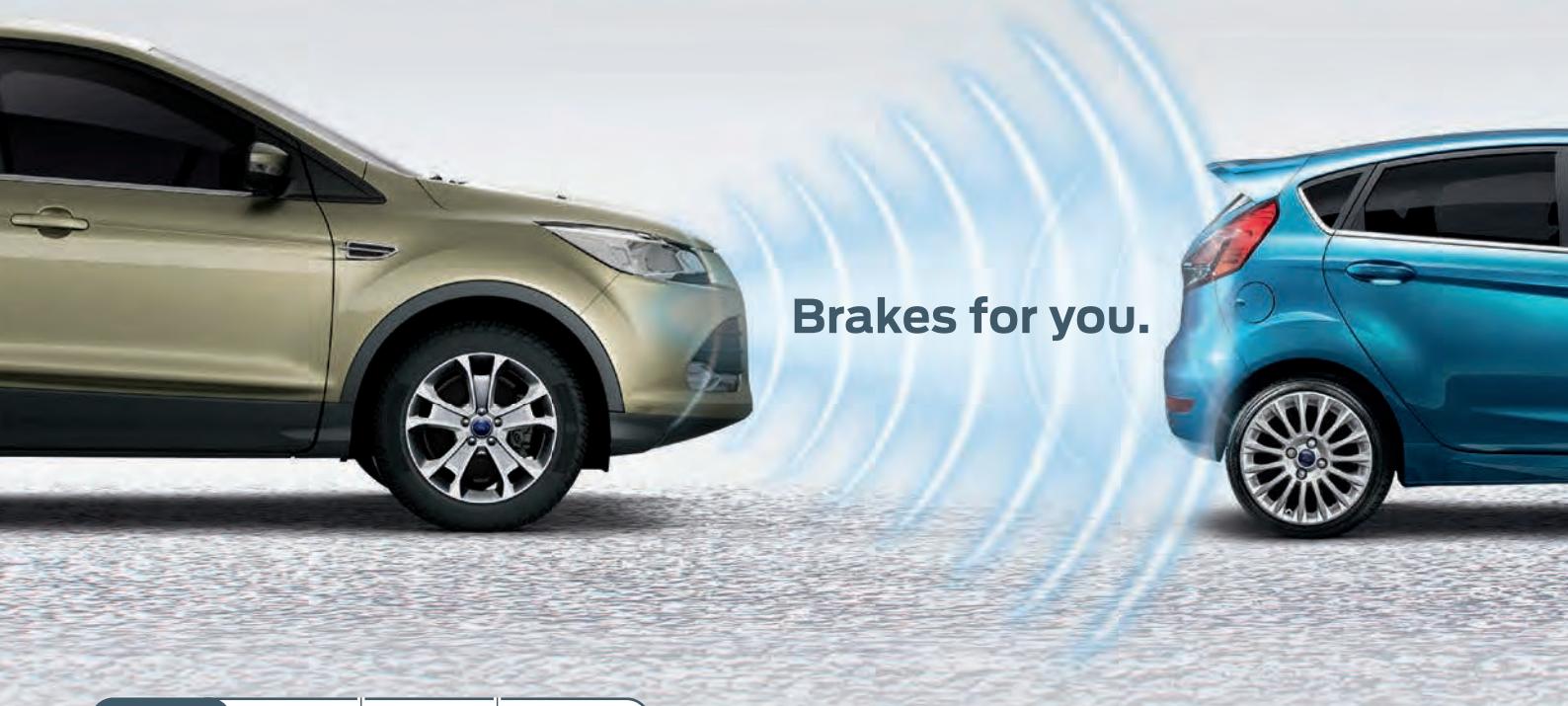
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'TIS THE SEASON TO BE GRATEFUL

AUTUMN IN THE CAPE is a season of many faces. The region's characteristic deciduous trees and huge fruit industry transform the landscape into vibrant reds and golds prior to that period when the American term "fall" seems so much more apt.

It's the season of wind, too. Proper gales, not the powderpuff breezes that summer holiday-makers complain about. Anybody who has ever ridden the city's annual Cycle Tour knows this only too well. Speaking of which, autumn is the season of big sporting events in the Mother City: the Tour and the Two Oceans Marathon a month later, at Easter, bring in thousands of visitors and millions of rand.

It's also the season of fire. On the eve of the 2015 Cape Town Cycle Tour, you'll recall, the mountain chain that symbolises the city was ablaze. Fierce winds drove the flames first this way, then that, up the mountainside and down. Communities were evacuated, vast tracts of vegetation and property destroyed, wildlife killed, roads closed and lives turned topsy-turvy. It's a scenario not restricted to the leafier suburbs, either. Areas of informal housing are particularly at risk and annually many thousands are displaced while seeing their meagre possessions go up in smoke.

Besides being profoundly grateful to those brave souls – many of them volunteers – who battle the inferno on the frontlines, we need to understand more of the whys and hows of these conflagrations. POPULAR MECHANICS will endeavour to bring those insights to you next month.

In the meantime, hug a firefighter today.

The latest addition to our team, Lindsey Schutters, had a fairly relaxed introduction to life at PM. A week after he started in December 2014, we went on our annual shut-down.

Since then, though, he's been keeping busy, it seems, squeezing into telephone booths (assuming that any can still be found) and re-emerging clad in a mask, cape and with underwear over a leotard. In his words: "As a world citizen and friend of the people I have a personal mandate to seek out awesome, uncover good and expose evil." When he finds some spare time between fatherhood and learning new things, he enjoys pushing his body to physical extremes. "I've heard my wife is a great person to spend time

with," he adds. "She does all the responsible adult things so I can hang on to my day job."

Having spent much of his career in the editorial engine room editing copy, Lindsey is relishing the opportunity to spread his writing wings. And how: for this issue he has made several substantial contributions, including our cover feature. This wasn't necessarily planned, but that's how it turns out. Stories sometimes take longer to develop than expected, things stop and start, interviews are rescheduled and trains are delayed.

Trains? You'll just have to keep an eye out for next month's POPULAR MECHANICS to find out.



anthony@ramsaymedia.co.za



Above: Cycle Tour roll call. Helmet? check. Gloves and pump? Check. Fire extinguisher? No need; we have people – good people – for that.



Left: New recruit and man of the world Lindsey Schutters will report on the global launch of Volvo's new XC90 sport-utility in Barcelona.

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Sheer
Driving Pleasure

USE TRUCKS TO POWER THE GRID

When I was an apprentice on the old South African Railways I worked on the electric locomotives, among other things. These units were driven by large direct current motors fed from an overhead line at 3 000 volts DC. When hauling a load on a downhill gradient, the drivers were encouraged to switch the motors to regenerative braking, thus turning the motors into generators. This braking effect was sufficient to control the descent of a train weighing many thousands of tons. The drivers were metered for the amount of regenerative electricity they had fed back into the overhead line on each trip and were paid a bonus depending on the amount they had "saved".

This has got me thinking about the large number of heavy trucks plying the route from Durban to Gauteng, estimated to be in excess of 1,5 million per annum. We regularly have runaway trucks on Town's Hill outside Pietermaritzburg and Van Reenen's Pass and this set me thinking.

Regenerative braking is already available to trucks as a form of braking system. The problem is that heavy resistor grids and fans need to be fitted to the vehicles to get rid of excess heat generated during this generating period, which in turn affects fuel economy.

Trucks could be fitted with the generator to provide the braking effect with a retractable pantograph such as the electric locomotives have. They could then feed back into an overhead power line at each downhill. At the compulsory truck-stop the pantograph could be raised and then the truck travels down the "Regen Lane", pushing electricity back into the grid for use by all and also to help Eskom to some degree. At the end of the downhill could be a "dead" section where the pantograph could be lowered without causing arcing and sparks while the truck is still in motion.

Maybe some guru with higher education than my technikon diploma might be able to make this economically viable.

BRIAN SIM
PIETERMARITZBURG

Write to us, engage us in debate and you could win a cool prize. This month's best letter wins a CAT PI 141 sport wristwatch with date. Designed for those who value understated ruggedness in a contemporary package, the PI 141 combines classic CAT style with the marque's legendary robust construction. It features a stainless steel case, black dial, quartz movement, chunky rubber strap and is water-resistant to 100 metres.

Send your letter to: POPULAR MECHANICS, PO Box 180, Howard Place 7450, or e-mail popularmac@ramsaymedia.co.za Please keep it short and to the point. Regrettably, prizes can be awarded only to South African residents.

Winning letter



A regeneration set-up would look something like this – albeit with the current going in the opposite direction. Our photograph shows Siemens' eHighway project, which involves powering heavy vehicles by electricity, much like railway locomotives.



Friends indeed

I just wanted to share with you guys how your magazine has become a bright facet in a great friendship.

Last year I, along with my good friend Gianni Volpi (you placed his tip regarding ball-bearings in one of your recent issues), had the awesome experience of going to Jakarta, Indonesia, for the World Robot Olympiad. After months of building, programming and troubleshooting, there comes a certain respect for the fact that everything in the natural world simply *works*. Only once you try to build it yourself can you understand the marvel of this world, and also strongly doubt that it was all created by accident.

We had a magnificent trip, learnt a great deal, and we are now giving classes in Lego robotics so that the younger kids can also experience the marvel of working with code and mechanics. To see a video of the robot we used at the WRO, go to <http://youtu.be/QRfpNDQ5gV4>

In any case, as we are constantly in discussion with each other about technological things, I am glad to inform you that the articles in POPULAR MECHANICS always are a very prominent part of our conversations. The photograph (left) shows us quite a few years back.

JOSUA BOTHA
BY EMAIL

Shedding light on crowd control

Some time ago you published details of the Megaray, a crowd control system that involves the use of an intense strobe light.

I am of the opinion that this sort of thing could have served the country well during the unrest at Marikana and, earlier, De Doorns. What is happening in many areas around the country provides present-day opportunities for such non-lethal devices to be employed.

KALLIE SNYMAN
Mahikeng

PM's faith content

It appears to me that PM, although an extremely good read on tech, lacks a certain depth when it comes to matters of faith.

A case in point is "High Tech meets high art" (February 2015). The artist concerned feels inspired to reinvent Eve as "master of the serpent" being "free, powerful, sexual and in control". Truth be told, this is the misguided opinion of the artist (as indeed Eve did choose to loosen herself from God by the very decision she made), but it does not befit a generally well-informed mag such as PM to publish such gibberish.

It is true that those involved in certain "scientific" matters tiptoe in a seemingly endless fashion on the border between faith and science, but then they should do so from a well-informed position. Thus, I (a trained electronic tech), while not professing to be an expert in science, do not venture into matters that I know nothing of, or have not at least gotten a second opinion on, or, at the very least, given a whole lot of thought to.

Lastly, I would venture a guess, that PM would not place such an article relating to or even referencing Islam. Why should your esteemed mag then do differently for Christianity?

COBUS VAN DER MERWE
BY EMAIL
(SHORTENED)

The name game 1

Mr Editor, welcome to the hot seat – may your reign be long and satisfying.

Your thoughts on change (Editor's notes, December 2014) are not uncommon, and it is generally accepted that change is as inevitable as taxes and death, and is a necessary factor of progress. None of us is impervious to change, but it affects us in different ways – fortunately! The younger one is, the easier it is to accept change and adapt to it. If this were not so, there would be no progress, or at best very slow progress.

Having said my bit (and in so doing, revealed my seniority), I must add that I was brought up in an era when change was slower and gentler of nature. In our family there is a Christmas trifle recipe that has been handed down to each new generation since it was first used in France (I think) in the time of Napoleon I. It has stood the test of time, and is today essentially the same as it has always been, and is still made and enjoyed by young and old alike. The old adage: "Don't fix it if it is not broke" springs to mind.

My subscription to POPULAR MECHANICS is about to expire in March, and I have been agonising about whether I should renew it or not. I was introduced to POPULAR MECHANICS about 60 years ago by an

older brother who used to buy it (soon after WWII), and have read every copy produced in SA since its inception, so can claim a long association with the publication, but I have finally come to a decision.

Not getting it every month is going to take some getting used to, but I have found that there is increasingly less copy lately that interests me, and I am no longer reading it from cover to cover, so cannot justify the cost each month. I will miss my read, but will adapt to the change. Thank you, POPULAR MECHANICS, for keeping me entertained and furthering my education for so many years. May you go from strength to strength with new subscribers to replace the "oldies".

One last thought: isn't it time for a change of name? "Popular Mechanics" doesn't seem to fit its present content mix very well. Maybe Popular Science or, if that is already taken, Your New World?

ALASTAIR JOHNSTONE
SANDTON

(Funny you should mention that...)

The name game 2

Somehow, for the past four decades, the "Mechanics" after the "Popular" in your title was imprinted in my mind as exactly that. Confined to mental images of gears and internal combustion *gedoentes*, your publication was given a Pass.

Now, I am one of those who love to take things apart, never to properly reassemble them. We are a generation of users that is keen to make tech our servants. But, because we do not comprehend basic technologies and developments, often the ever-increasing new technology and its associated jargon become our unpopular masters. We lose the ability to create good BS filters through a lack of comprehension and willingness to part with resources of time and money necessary to get on top of everything.

My inquisitiveness had remained frustratingly unmanageable and unrequited until I opened your mag after all of these years. It gradually answers the many questions that I have had without paying for courses and doing Web work with enough links to build a chain that plain just sinks your enthusiasm. I subscribed digitally, uploaded the back issues free and use Adobe Reader to deliver the goods. As the mag seems to cover much technology and value-to-life articles on all sorts of things, is it not time for a name change. What about Popular Life Technology?

WILLIAM MALONEY
BY EMAIL



A safer bathtub wagon

Anyone wishing to tackle the wooden wagon project (pages 86-87, January 2015) should consider that one of the first things toddlers will do is to try and climb on to the wagon. If the design is not stable, the wagon will tip over. So, it's a good thing to have the wheels as far apart as possible, so that the torque exerted by a (let's say 10 kg) toddler about any axis through the four contact points does not exceed the counter-torque exerted by the centre of mass through the same axis.

The wooden wagon design barely meets this requirement, even when the rear wheel trucks are attached as far as possible to the back of bottom panel. I was taught this important point through trial and error by my own son, aged 14 months.

Consequently we had to make several modifications to my design, which entailed using his baby bathtub and a set of wheels from an old stroller. Luckily he did not lose confidence during the process of educating me on torques.

He now loves being pulled around in his bathtub wagon and can jump in and out from any direction without it tipping. With its floats attached, he can even use it in the pool.

PROFESSOR AE BOTHA
UNIVERSITY OF SOUTH AFRICA



Stuff to do during loadshedding

1. Lie on the couch with your cat.
2. Catch up on reading your POPULAR MECHANICS mags.
3. Maybe you'll learn how to make a generator!

BRIAN GAYNHAM
BY EMAIL PM



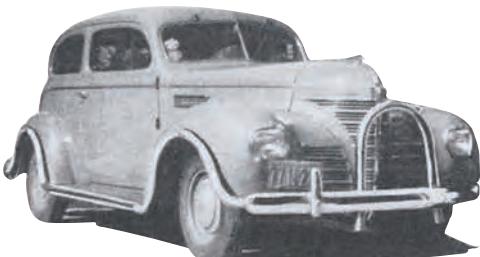
1931 A network of aerial guidepost towers – 60 000 of them – were envisaged by a Cleveland man who built the first in his home city. In his vision, each tower would bear code letters expressing its latitude and longitude. This might direct aviators in the day when thousands would fly the airlines in their own planes, we said at the time. Sadly for the inventor, developments in radio technology rendered his idea redundant.



1929 Promising a kind of Turkish bath in the comfort of home, this bag made of rubberised material closed around the user's neck and had steam piped in by a unit alongside. "Head and arms are left free for reading, smoking or answering the phone," we noted.

A vibrant, full-color illustration for the April 1942 issue of Popular Mechanics magazine. The cover features a large naval battleship in the foreground, its deck crowded with sailors. One sailor is looking through binoculars. The ship is firing its main guns, with bright orange and yellow muzzle flashes and smoke billowing from the barrels. In the background, another ship is visible on the water under a clear blue sky. The title 'Call to Battle Stations' is at the top in a stylized font, followed by 'POPULAR MECHANICS MAGAZINE' in large, bold, red letters. Below the title, it says 'WRITTEN SO YOU CAN UNDERSTAND IT'. The price 'APRIL 25 CENTS 30¢ IN CANADA' is in the bottom left. A small sign on the battleship reads 'SEE PAGE 17'. In the bottom right corner, there is a small graphic for 'BUY UNITED STATES WAR BONDS'.

1942 In April 1940, with Europe fiercely engaged in World War II, a review of the US fleet proudly showed off its naval muscle. Two years later, the April 1942 issue (cover headline: "Call to battle stations") featured an apparently undaunted navy post-Pearl Harbour. Amid the hype, the rallying cries and the earnest injunctions to American patriots, a little feature on spies in the fashion world using such subterfuges as cameras hidden in shoes struck a mildly bizarre note.



1940 Whether through lack of confidence in his own driving abilities or that of fellow roadusers, a Los Angeles physician built this ring of steel around his car. It seemed to have worked: after a mysterious incident involving a ditch, the only damage was a few minor scratches, apparently. **PM**



* Good buy or bad location? Context matters.

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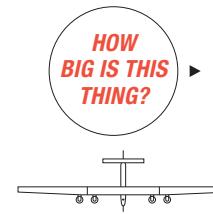
HOW YOUR WORLD WORKS

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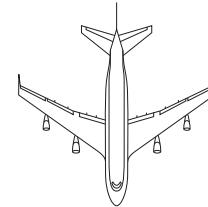
THE SUN PLANE

They're the Amelia Earharts of clean energy: this month Swiss pilots Bertrand Piccard and André Borschberg will attempt to become the first people to circumnavigate the world in a solar-powered airplane. Their twelve-leg, 35 000 km trip will take five months to complete, beginning and ending in Abu Dhabi, with stops in North Africa or southern Europe and the United States. We had a few questions. BY RACHEL STURTZ

The Solar Impulse 2 in the middle of its first test flight on 2 June 2014, near Payerne, Switzerland.



Solar Impulse 2
WINGSPAN:
72 m
WEIGHT:
2 268 kg



Boeing 747-400
WINGSPAN:
64 m
WEIGHT:
180 tons

Who are these guys?

Bertrand Piccard (far right) is an aeronaut who co-piloted the first nonstop trip around the world in a balloon in 1999. In 2003, he teamed up with André Borschberg (right), an engineer and former fighter pilot. With a crew of eighty engineers and technicians, the two devoted the next twelve years to developing one of the most innovative solar-powered, machines on the planet.



Will this be their first attempt?

At travelling around the world, yes. There was an earlier prototype, Solar Impulse 1, that broke eight records, three of them when Borschberg flew it for 26 hours straight in the first night flight in the history of solar aviation. They're now on to Solar Impulse 2, which has greater energy density in its 635 kg of lithium-ion batteries and improved 13 kW electric motors that spin the propellers with 94 per cent efficiency.

How comfortable is the plane?

Not very, especially considering that it is unpressurised and has no heat. Borschberg and Piccard will have oxygen tanks to deal with the altitude, but they'll be forced to endure temperatures that fluctuate between -20 and -30 degrees Celsius with only small warmers for their hands and toes.

How do they sleep?

They don't, really. Since only one pilot can fit in the three cubic metre cockpit at a

time, he is allowed just six 20-minute naps a day while the plane is on autopilot. Both men have trained in meditation and self-hypnosis to rapidly enter deep sleep and wake up alert.

Is there a bathroom?

The longest and most demanding leg of the trip is a five-day stretch of continuous flight over the Pacific, so it wouldn't be fair to expect the pilot to wait for a rest stop. The seat, which can recline completely for naps and physical exercise, also serves as a toilet – by removing the cushion of the seat as you might on a private plane.

If it's a solar plane, does that mean it can't fly at night?

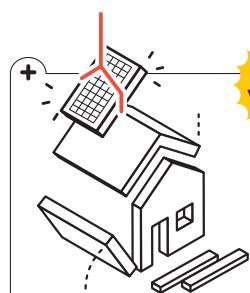
The plane uses stored energy to fly in the dark. So as not to exhaust its reserves, Solar Impulse 2 takes advantage of gravity, gradually gliding down to an altitude of 1,5 km at night. During the day the pilot regains a cruising altitude of 8,5 km – where there is lower air density and drag – and can reach a top speed of 138 km/h while the batteries are recharged.

Are they scared?

The plane has never flown in inclement weather or periods of turbulence. In case they do run into trouble, the two have been practising parachute landings and treading water in the North Sea. "If oxygen runs low, if there's not enough energy to fly through the night, or if autopilot doesn't work, we'll end up in the water," says Borschberg.

Okay, so what's the point of all this?

Although Piccard admits that solar-powered commercial flights may never happen, "we would be able to cut the world's energy consumption in half if we replaced old technology with current technology," he says. They also hope to inspire more businesses to consider clean energy. They've already heard from companies that want to use their technology to replace satellites with cheap, unmanned aerial vehicles for transmitting telecommunication services to developing countries.



SOLAR IN YOUR HOME

Eskom ended its involvement in the funding and implementation of the solar water heating programme on 31 January 2015 after only reaching 400 000 households out of 2008's originally targeted one million rollout. Outstanding tax rebate claims were due at the time of writing and the Department of Energy will announce details of a future solar programme shortly after taking over the project on 1 February. The solar programme under Eskom's stewardship suffered setbacks because many local suppliers failed to obtain the required SABS approval. Eskom did however honour all rebate claims and the 400 000 installations makes it one of the biggest solar heater roll out programmes in the world. The Department of Energy was unavailable for comment.

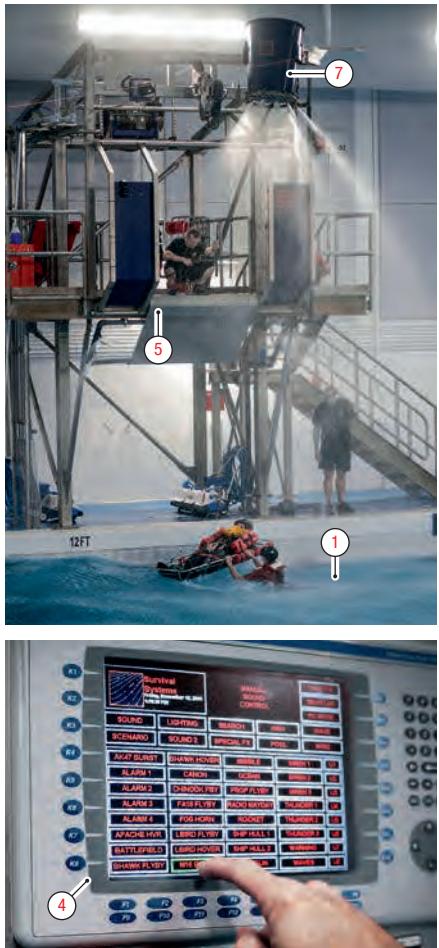
THE WORLD'S WILDEST POOL

At the US Coast Guard's rescue-swimmer indoor training facility, the water is not fine. That's the point. BY STEPHEN MADDEN

STEPHEN MADDEN

COAST GUARD RESCUE SWIMMERS sometimes have to abseil down cliffs and dangle from helicopters to save people from churning seas. During big storms. At night. How do you get people ready for such fearsome errands? You send them to the service's Aviation Technical Training Centre in Elizabeth City, North Carolina, home to a R250 million indoor facility that can whip up approximations of the waves, bellowing wind, horizontal rain, and disorienting noise that rescuers will eventually face.

In that building over the course of a year, instructors literally wash people out of the Aviation Survival Technician certification process. Only about twenty-five applicants annually – out of 120, most of them men between the ages of 18 and 25 – finish the course to become certified rescue swimmers. The facility gets a fair amount of the credit for that attrition rate – it's built around two pools where instructors can dial up a Category 1 hurricane anytime they want. "This is the best we can give them in a controlled environment," says Senior Chief Petty Officer Jason Schelin, head instructor at the school. Here's a look inside.



The main pool ①, which is 25 metres by 50, holds 4.5 million litres of water and is a uniform four metres deep except for 1.2 m ledges on three sides. A movable bulkhead with a massive overhead curtain can create two separate training environments for the classes that come through. Every weekday the swimmers spend two hours in the water working on their conditioning. That means endless laps in a mask, snorkel, and fins and the occasional order to pair up and move a brick along the bottom of the pool – the 25 m length of the pool – with one swimmer at a time coming up for air.

An adjacent 950 000 litre pool houses the “Dunker” ②, a hoist that can flip over accurate mockups of a small boat and a helicopter so crews can practise escaping from downed or capsized craft ③. The entire room, including a wave machine, is controlled from a single panel on the hoist ④.

Twin towers on either side of the bulkhead feature platforms 54.5 m above the big pool's surface – the height at which swimmers jump off hovering helicopters during missions. The platforms are equipped with the same hoists that are attached to the MH-65s the Coast

Guard flies during rescues.

Two giant fans **6** create everything from zephyrs to 130 km/h winds, while nozzles direct water into the gusts to produce driving rain and spray. A fan above the towers **7** simulates propeller wash. And roaring above those fans: recordings of helicopter props and engines, thunder and heavy winds, all played at realistic volumes. Flashing strobes provide simulated lightning. The devices ramp up the difficulty level in skill training – towing a buddy or trying to free a pilot from his parachute.

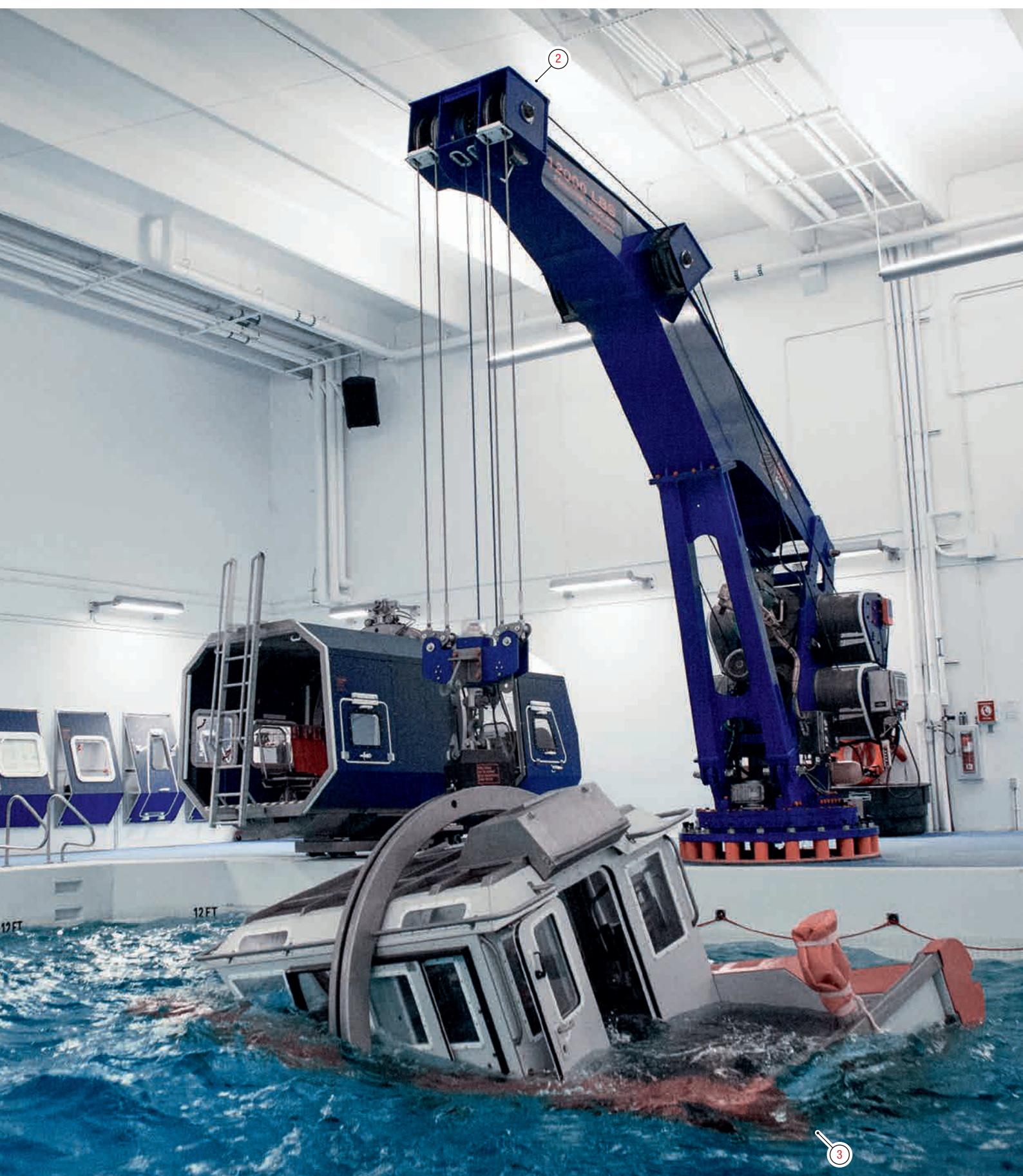
Both pools have wave machines that can produce rough seas with waves as high as one metre. In the big pool two high-volume fans force air into a caisson behind the building. The caisson drops, pushing water down. When it rises again, so does the water, creating waves.

In the smaller pool a giant ball floating on the surface is pulled down on its moor line and then released repeatedly to create wave action. Water levels are kept a couple of metres below the maximum height – there are no spill lanes like those you'll find in a competition pool – to magnify the effect of the roiling water.

PHOTOGRAPHS BY BOBB SCHABETG

► Swim 460 m in 12 minutes ► Run 2,5 km in 12 minutes ► Do 40 push-ups

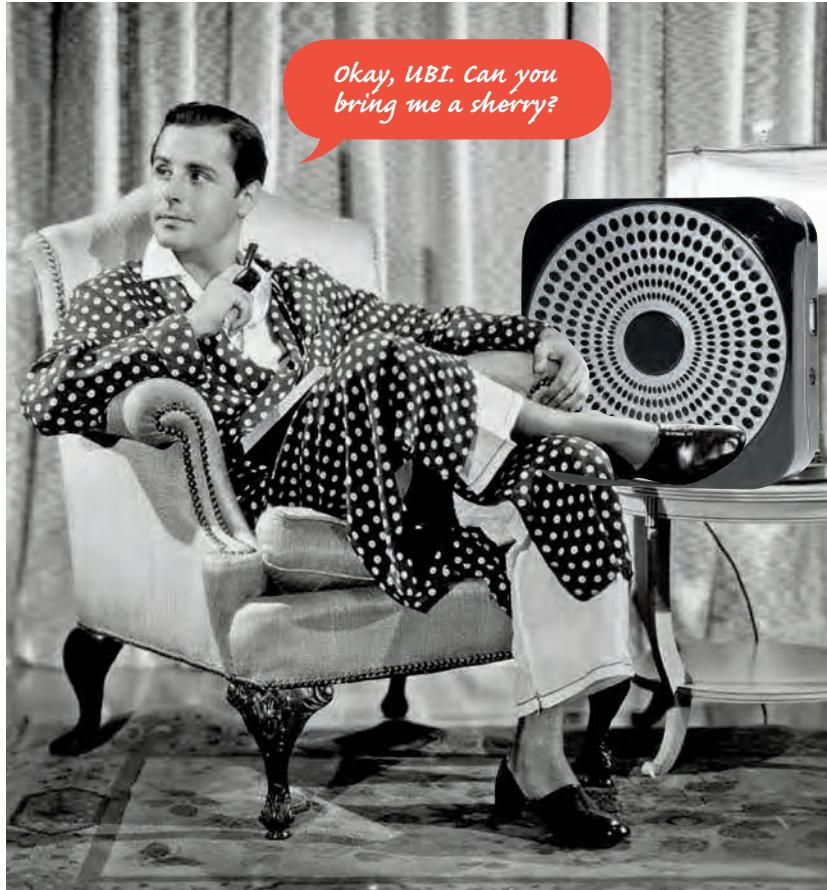
and 50 sit-ups in 2 minutes each ► Do 3 pull-ups and 3 chin-ups without stopping





THE UPGRADE: SPEAKERS THAT FLOAT

A little secret about Bluetooth speakers: They're all pretty much the same. Some are clearer, some are louder, some are better at working after you drop them into the pool, but for the most part you pick a price point and you get music. Which is why speakers like the Crazybaby Mars are following the example of the Om/One, using opposing magnets to float above a base. They're no better than existing speakers, but they're also no worse. They're definitely more interesting.



SIRI FOR YOUR LIVING ROOM

Technology you might forget is on your phone becomes useful when you take it home.

BY ALEXANDER GEORGE

I'VE USED SIRI – ONCE, TO SEND A TEXT in the winter when I didn't want to take off my gloves. After that, never again. And I don't think I'm alone. As good as voice recognition gets, aside from the occasional party trick, most people I know seem to forget it's there. A few companies, however, think they can change that. We just have to be in the right setting.

Ubi is a Wi-Fi-connected, wall-mounted speaker the size of a sandwich made from those large Albany slices, with an always-on microphone that listens for your commands. (In what seems like a move to keep pace, Amazon soft-launched a simi-

lar product last fall, the Echo, right, available by invitation only.) Say "okay, Ubi," from within two metres, and it beeps twice in acknowledgment.

From there you can ask it anything. With practise it almost feels natural to pause your movie and ask, "What was Charlie Chaplin's first film?" After a two-second pause – long enough to query Google – Ubi will tell you it was *Making a Living*, from 1914. Ubi follows basic commands too. I asked it to play music by Howlin' Wolf and its twin three-watt speakers played tracks from Grooveshark, the free music-streaming service. After boiling water, I told it to remind me in six minutes to check if my pasta was al dente. You can also co-ordinate Ubi to work with smart-home devices through IFTTT (If This Then That, software that lets you program a response to a trigger event, like saving every photo you post to Instagram in your Dropbox storage). After a few minutes of set-up, I could tell Ubi to change my Philips Hue bulbs to red or to turn on a space heater I connected to a Belkin WeMo switch.

Ubi's most distinct advantage, however, shows up when you're in a group. When a friend and I were certain we knew the capital of New Zealand, rather than removing myself from the conversation and getting lost in my phone, I asked Ubi. Everyone heard the answer. (It's Wellington, by the way.) You get the immediacy of the Internet without the isolation.

If only the experience were more consistent. Auto-correct and Google suggestions can compensate for my infantile spelling, but telling Ubi to "turn off the light" was met with silence, since my IFTTT command was listening for "turn off the lights," plural. Plus, over three days, several TV actors woke Ubi by saying "okay". But those flaws can be fixed. The real obstacle is us and how quickly we can come around to the idea of talking to something that isn't human. The home, with its inherent privacy, is a great place to start.



The Amazon Echo functions much like Ubi. But you can get one only if you're lucky enough to be invited.



The Myris.
Reading irises is up to 150 times more accurate than fingerprints.



MEANWHILE, IN
ONLINE SECURITY...

YOUR NEXT PASSWORD: YOUR EYEBALL

People can hack your passwords. But they can't hack your eyes.

BY SARAH Z. WEXLER

YOUR PINTEREST ACCOUNT is about to be safer than ever. EyeLock, a company known for making iris scanners for security checkpoints at banks, recently introduced an at-home device called Myris. It stores your passwords locally, instead of in the vulnerable cloud, and encrypts them. The only way to access them is by scanning your eyeball.

Set-up is simple: plug the palm-sized Myris into your computer's USB port and look into the camera. Once it has identified and logged some 240 unique points in your iris, you can create a username and

add your passwords. After that you never have to type a password again. Just sign in with your eye when you turn on your computer and all of your passwords are automatically input, except for time-sensitive passwords for things like banking sites, for which you'll need a rescan to access. When Myris runs smoothly, you wait about ten seconds and see a brief flash of light. But when the device acts up, which in our tests was a little less than half the time, expect a few retries – and to see spots for a minute or so after.

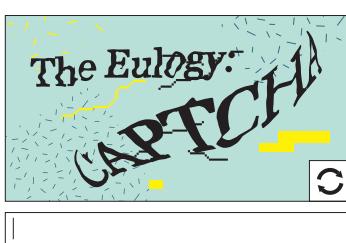
It's impressive, and it's allegedly

un-hackable. While fingerprints offer about twenty points of difference, the human iris has twelve times that. Not even identical twins have the same iris texture. The only downside, other than those pesky (but temporary!) blind spots, is that in order for Myris to work, you need to have it with you. So if you have your laptop but forgot your fancy new scanner, or if you're checking your email from your phone, you'll still have to type in your password. Which will be even harder to come up with after months of not having to remember it. (Hint: It's your dog's birthday.)



THE EKG PASSWORD

The upcoming Nymi Band identifies you with your heartbeat, then uses Bluetooth to automatically log you in to any application.



→ You know CAPTCHA, the hard-to-read jumble of letters, numbers, and obfuscating lines that supposedly confirm your humanity every time you go to buy Taylor Swift tickets? Well, it's getting phased out. Besides being infuriating to real people, especially those using mobile devices, CAPTCHA is no longer fooling the robots. Succeeding it is Google's No CAPTCHA reCAPTCHA, a much simpler set of boxes you click in answer to basic prompts ("Pick your favourite color," "I'm not a robot") that started rolling out late last year. The system analyses your IP address, browser cookies and even the way your mouse moves. It's a way to prove you're human and it's finally humane.

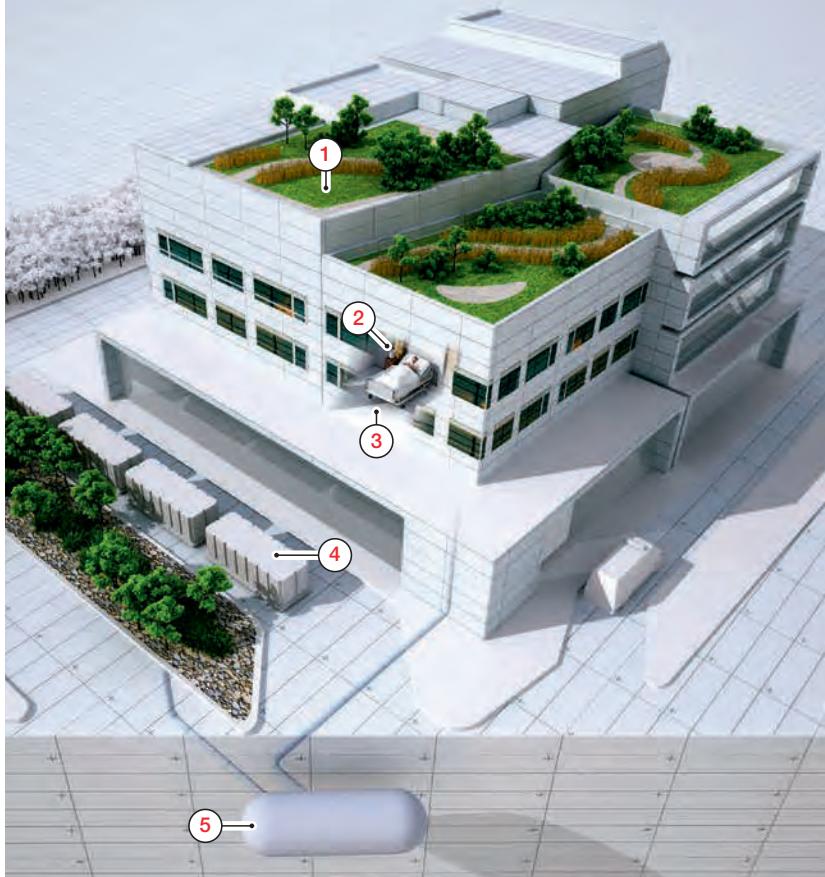
HOW YOUR
WORLD WORKS

HOW TO MAKE A SUSTAINABLE HOSPITAL

Hospitals are energy hogs. They don't have to be. BY KEVIN DUPZYK

A N EARTHQUAKE CAN HAVE POSITIVE SIDE EFFECTS.

Like in 1994, when, in response to an earthquake that damaged many hospitals in the San Fernando Valley, California issued seismic safety regulations specifically for patient-care facilities. But they were never instituted – until last summer. Now a huge number of California hospitals are being retrofitted or completely replaced and officials are seizing the opportunity to address sustainability by incorporating some of the most advanced technology available. The result is a petri dish of innovation – and a model for the industry.



① Plant a garden.

Rooftop gardens reduce storm-water runoff and provide better insulation, which can result in an average savings of up to 40 per cent on heating and cooling bills. Plus, research shows that green space helps the healing process. University of California San Francisco Medical Centre at Mission Bay features 5 000 square metres of green in five rooftop gardens, three of which are accessible to patients.

Where: San Francisco
When: February 2015

sensors, the hospital's HVAC system and patient records to control heating and cooling. When a room is empty, the system adjusts to the minimum ventilation settings. When a patient is present, he can choose the temperature through a programme on his TV. The programme is saving the hospital about R1,75 million a year and reducing the surprising number of injuries sustained by patients who leave their beds to change the thermostat.

Where: Mountain View
When: June 2014

Centre installed rubber flooring that can be maintained without harsh industrial cleaners. It has an added advantage of reducing both hospital noise and joint impact. Good news if you just got your knee replaced.

Where: Oakland
When: July 2014

④ Make your own power.

Sutter Regional Hospital meets an estimated 70 per cent of its energy needs through on-site fuel cells. The solid-oxide cells are stacks of ceramic discs painted with conductive inks. Put oxygen on one side and natural gas on the other and oxygen ions flow between them to produce electricity – clean electricity not from the grid,

and thus not derived from coal or hydroelectric power. Which means Sutter reduces its annual contribution to CO₂ emissions by nearly 272 000 kg, and water use by 4,6 million litres.

Where: Santa Rosa
When: October 2014

⑤ Stop wasting rain.

Lucile Packard Children's Hospital captures rainwater, condensation from the HVAC system, and any other spare droplets it can, and stores it in a 420 000 litre underground reservoir. That water isn't sterile enough for patients, but it can go towards irrigation, lessening the draw on the clean water supply.

Where: Palo Alto
When: December 2016

② Turn off the heat – selectively.

El Camino Hospital created something of a connected home set-up, which integrates room-based

③ Replace the floors.

Hospitals are the last places that should use even slightly hazardous or carcinogenic materials, so the new Oakland Medical

THINGS YOU MAY ENCOUNTER AT THE DOCTOR'S OFFICE

THIS MONTH:
THE EYE
DOCTOR!



Autorefractor. Measures cornea curvature as an object shifts in and out of focus, then averages those readings to approximate your prescription.

PM'S VERDICT: Easy, relatively accurate, especially good for kids.



Optical coherence tomography machine (OCT). Provides a cross section of the retina, often precluding the need to have your pupils dilated.

PM'S VERDICT: Great, but requires a skilled operator.

THIRST FOR KNOWLEDGE

Swords into ploughshares? Try bottles into walls with a local company that repurposes beverage containers to build classrooms

TSOMETIMES SEEMS LIKE OUR throwaway society is simply drowning out those who would like to live more sustainable lives. Happily, that's not always the case. One good example: using recycled plastic bottles to build walls – not between people, but around space to create classrooms.

Bottleworx, a company based in Benoni, Gauteng, has developed a functional container suitable for all liquid and granular products. Like many containers of their type, they are made of polyethylene terephthalate, commonly known by its abbreviation PET. The plastic used for Bottleworx's bottles is said to be more planet-friendly by its avoidance of controversial Bisphenol A (BPA), which has been shunned because of its supposed hormone-like properties. But, more than that, these particular bottles are intended not simply to be recycled by being chemically reprocessed. They are actually designed to be used as building blocks.

According to Bottleworx, the bottles interconnect and, when inserted into a steel frame, form a strong, stable wall. In that way they form the basis of

Bottle2Build, a nationwide initiative.

There is a commercial aspect to it: schools sell the company's partner products in their tuck shops, then encourage pupils to collect the empty bottles and place them into collection bins. Once 90 000 bottles have been collected, Bottle2Build will build a classroom. Several corporates have got in on the act as well and the Spar supermarket group has become part of the recycling chain.

Suzuki Auto South Africa, in conjunction with its advertising agency, Penguin, recently funded the construction of two classrooms at Bulugha Primary School in rural Eastern Cape near East London. The 160-strong school, which serves the surrounding farms and settlements, is desperately lacking in resources.

Until recently, the school had shared classrooms for Grades 1 to 3 and Grades 4 and 5.

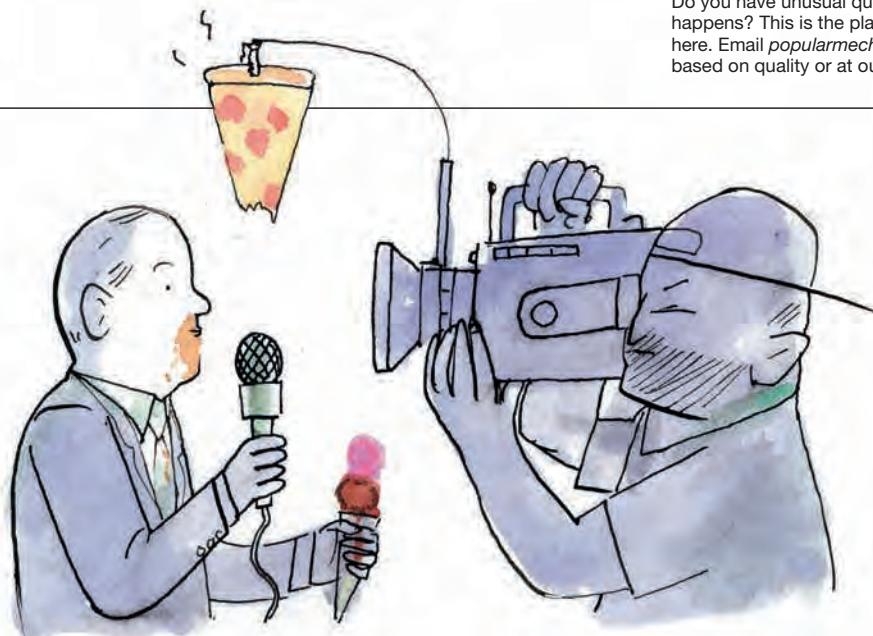
Suzuki took the opportunity to showcase its involvement by swinging by the school during the launch of its new Ertiga wagon. Managing director Yukio Sato, lauding what he called an investment in the country's future, urged other corporates to get involved in similar projects.



Top and middle: Interlocking bottles are repurposed to form the basis of walls. Above: Bulugha Primary School principal Matthew Madwara proudly shows off his new classroom.

Find out more: <http://bottle2build.co.za/>





Q

IT IS SAID THAT THE CAMERA ADDS 5 KILOGRAMS. IS THERE ANY SCIENTIFIC BASIS TO THAT CLAIM?

A Bacon cheeseburgers add 5 kilograms. The camera merely reveals this stark truth more efficiently than the human eye. How? Let us count the ways.

In real life, we tend to see ourselves several times a day, every day, so we may not notice the insidious encroachment of middle-age spread. Freeze a moment in time and examine it in isolation and it's suddenly, "Dang, when did I get so fat?" Lighting plays a role, as well. Usually parts of our faces or bodies are shadowed, which helps define edges and contours. A flash photograph, which fills in those voids, can flatten – and thereby fatten – us.

Moreover, we're used to seeing ourselves and others from certain conventional distances. Alter those apparent distances and a person's looks can change. That's because the brain assesses the size of a face by using the distance between features seen from a typical vantage point to establish scale. Change the ratios substantially and the brain interprets a person's appearance differently. Rule of thumb: the closer you are to the camera, the thinner you'll look.

Finally, the fact that we have two eyes, whereas the camera has only one, works against us. Our two-eyed view contains more background than a typical camera lens captures. An object looks larger against the camera's seemingly smaller background, and vice versa. So try to pose in front of, say, the national debt.

Is radiation from my cellphone affecting my sperm count? And if it is, would wearing that radiation-shielding underwear I've seen actually help?

On the whole, cellphones have been a boon to the male reproductive function, giving rise to such modern courtship rituals as the late-night booty call, bored-at-work sexting, and, of course, the old "I think I dropped my phone down your pants" gambit. Even so, some research does suggest that cellphone use may reduce male fertility.

In assessing such matters, researchers concern themselves with three specific measures: motility (how many sperm cells swim upstream), viability (how robust they are), and morphology (how well-formed the cells are). A 2007 study at the Cleveland Clinic

Do you have unusual questions about the world and how it works and why stuff happens? This is the place to ask them. Don't be afraid. Nobody will laugh at you here. Email popularmechanics@ramsaymedia.co.za Questions will be selected based on quality or at our whim.

found that all three fertility measures deteriorated among 361 male subjects as their reported cellphone use rose.

However, other studies have failed to demonstrate a correlation between cellphone chatter and damaged baby batter. Settling the question conclusively would be extremely difficult for a few reasons, including the challenge of assembling a true control group, namely, a large enough pool of men who don't use cellphones.

As for the underwear, while apparently it does shield your junk from radiation (it's more than 99 per cent effective, one study reported), nobody knows whether radiation is even the culprit, assuming cellphones do, in fact, affect fertility. What we do know for certain is that announcing that you're wearing anti-radiation briefs is 100 per cent effective at preventing you from getting laid.

If it takes less refining to make diesel, then why does it sometimes cost more?

If a Third World factory can slap together a TV set for a few bucks, how come my last flat screen cost ten grand? Because how much something costs to produce has little direct bearing on how much it sells for. Indeed, Economics 101 teaches us that market price is determined by two factors – supply and demand. (Though, for the record, the cost of refining diesel has risen of late, due to new regulations that require the removal of sulphur from the fuel.)

Demand for diesel fuel in the United States remains low by worldwide standards. Truckers use it, of course, but very few American passenger vehicles do. In other countries, conversely, they love, love, love their diesel-powered vehicles. Can't get enough diesel. ¡Mas diesel, por favor! They'd wash their dogs with it if they could.

The upshot of this is a double whammy: US refiners are producing less diesel (because there is less demand), and they are exporting more of what they do produce to countries where there is more demand. This results in – drumroll, please – a reduced US supply relative to a low but stable demand and therefore – another drumroll, please – a higher price. **PM**

thirtyfour/5665/E

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WE ARE IMPERIAL

GREAT STUFF



HISENSE INFINITY H6 SMARTPHONE

Dual SIM communicator



Looking for an affordable handset that can take advantage of different network deals? Check out Hisense's new Infinity H6 smartphone. Enabled to run two SIM cards (either a data SIM or call SIM, or two different call SIMs), it allows you to manage different accounts and networks on one device to keep costs down.

On the phone front, it features a quality, all-metal body. The 12 cm capacitive multi-touch HD display is large enough to display significant amounts of information, yet can be handled comfortably with one hand. Another cool addition is its special recognition ability, which provides shortcuts to key functions with a simple swipe. It's also great for online socialites: all you need do is hold up your hand, clench your fist – and three seconds later, the phone will take the snap. No selfie-stick required! Other features include Android 4.4 KitKat OS, Dolby Digital Sound, Snapdragon quad-core 1.2 GHz CPU, 1 GB RAM, 16 GB storage (expandable up to 32 GB), 8 MP rear camera with LED flash and 5 MP front camera, and LED torch. Price: about R3 500. Contact Hisense on 0860 447 373 or visit www.hisense.co.za



SEALIFE MICRO HD+ UNDERWATER CAMERA

Snapper down

Most underwater cameras have fiddly components such as O-rings on openings to keep water out. Happily, SeaLife's Micro HD+ isn't one of them. That it's permanently sealed is a big deal – ask anyone who's had to painstakingly pick grains of sand off their camera seals (after downloading their last shoot). Miss just one grain, and the waterproofing's stuffed for the next dive.

Operated by three wide "piano key" controls, it's said to be extremely easy to handle underwater, even when wearing gloves. Capable of capturing 13 megapixel stills and Full

1080p HD video, its 140-degree fisheye lens gets you close to your subject and still fit everything into the frame. There's an easy set-up guide that provides users with a fast and intuitive way of selecting the correct colour mode for a dive. Rated to depths of 60 metres, it features 32 GB of internal storage (enough for around 8 000 images or 6 hours of video), a fully rubber-armoured and shock-resistant body and a 6 cm TFT colour LCD screen for easy on-camera viewing. Images and video are downloaded to computers and other smart devices via Wi-Fi. And, for those wanting to up their game, up to two Sea Dragon photo/video/dive lights can be fitted. Price: about R7 500. Contact Scuba Equipment Africa on 011-444 6563 or visit www.sealife-cameras.co.za



ZARTEK 1600LM LED FLOODLIGHT ▲

Light, when you need it most

Zartek's 1600LM LED floodlight has nine LEDs, totalling an output of 1 600 lumens, propelling its beam 100 metres. Powered via any vehicle's 12 V socket, it can be attached to bull or roof bars. Shock- and rain-proof, it comes with a 5-metre cable. The beam is said to be good for 30 000 hours. Price: about R1 100. Contact Outdoor Warehouse on 0800 003 051 or visit www.outdoorwarehouse.co.za



BLACK DIAMOND EMBER POWER LIGHT ▲

Illuminate and charge

Black Diamond's Ember Power Light is more than just a torch. Capable of pushing out 150 lumens of light, it also charges mobile devices via its integrated USB port. Its rechargeable, sealed 2 600 mAh lithium polymer battery takes about eight hours to charge via a wall socket. The TriplePower LED has a throw of about 40 metres and there's a battery lock mode to eliminate drain during storage; a power meter indicates remaining battery life. Plus, it's splashproof. Price: about R680. Contact RAM Mountaineering on 021-532 0549 or visit www.rammountain.co.za



GREAT STUFF



CANON EOS M3 COMPACT SYSTEM CAMERA

Mini muscle

Serious photographers wanting the creative flexibility of multiple lenses, but with a smaller camera body, should check out the diminutive EOS M3. At its heart is Canon's first 24.2 megapixel APS-C CMOS sensor and latest DIGIC 6 image processor. The end result: stunning visuals, from large stills to Full HD 30p video. Thanks to its 49-point autofocus system and innovative Hybrid CMOS AF III technology, whether you're shooting an elusive critter in a game park or street performer in a bustling city, your focus will be sharp. In fact, it boasts a sixfold improvement in focusing speeds when compared with the original EOS M. The sensor's vast 100 – 12 800 ISO range means it's great at handling low light conditions, too.

Budding videographers will like its Touch AF functionality, which gives them the ability to select focus points on the 7.5 cm LCD screen to create professional-looking pull focus effects. Also included is integrated Wi-Fi and NFC connectivity, which takes the hassles out of downloading content. Price: about R8 000. Contact Canon on 011-251 2400 or visit www.canon.co.za



ASUS TRANSFORMER BOOK T90 CHI

Two devices in one

Why struggle to choose between a small notebook or tablet when you can have both? Asus's new Transformer Book T90 Chi is a tablet when you want it and a compact notebook to get serious work done while on the road. Razor-thin at just 7,5 mm, the tablet features a 22 cm seamless all-aluminium unibody design that weighs 400 grams undocked. Hook it up to the Bluetooth keyboard and it still only weighs 750 grams, making it a great option for those wanting to travel light. Speaking of connectivity, its hinge mechanism incorporates neodymium – the world's most powerful magnetic material – precisely arranged to ensure secure, reliable and fuss-free docking.

The crisp WXGA 1280 x 800 IPS display boasts a 20 per cent wider colour gamut range to provide a more vivid and accurate image. Efficient processors provide all-day battery life, apparently with no compromise – and no noise, either, thanks to a fanless design. Other features include ultra-fast, responsive all-solid-state storage, fast USB 3.0 connectivity and Windows 8.1 32-bit operating system. Price: about R7 000. Contact Asus on 0861 278 792 or visit www.asus.com/za



BROTHER MFC-J2720 INKJET MULTI-FUNCTION CENTRE

Printer for all occasions

This baby churns out 22 monochrome or 20 colour pages per minute – directly from your digital camera, media card and USB memory stick without the need to turn on a PC. It supports mobile and cloud printing and comes with a multi-purpose tray to accommodate envelopes, labels and paper of varied thickness up to A3 in size. Two-sided printing functionality helps you save on paper, while its automatic two-sided scanning and faxing function helps save time. It also offers the option of affordable 2 400 page-yield black and 1 200 page-yield colour cartridges. Price: about R4 500. Contact Brother on 012-345 3886 or visit www.brother.co.za



GRAVITY MAZE LOGIC GAME

Mind bender

If you enjoy putting your visual perception and reasoning skills to the test, the Gravity Maze logic game could be for you. Breathtakingly simple in principle, yet maddeningly complex to execute, it involves arranging translucent towers to move a marble from one location to the next, using gravity alone to accomplish the task. Needless to say, the moment you start adding extra towers into the mix it can get surprisingly complex, fast. The game includes one game grid, 60 challenge cards (beginner to expert), nine towers, one target piece and three marbles. Price: about R450. Contact Think Tank distributors on 031-267 1619 or visit www.ttdistributors.co.za



PLATYPUS GRAVITYWORKS ▲

Thirst quencher

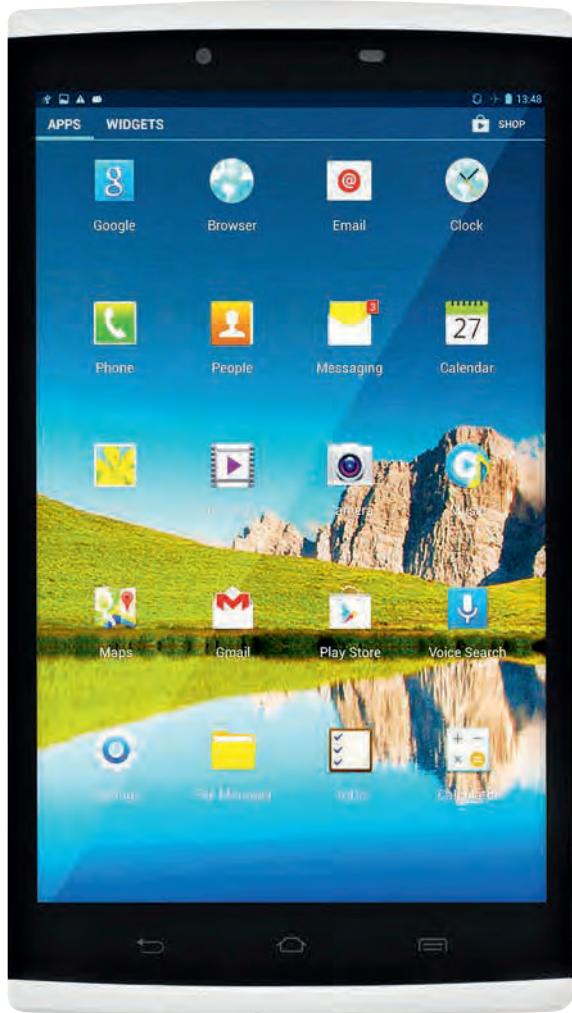
Remaining hydrated while subjecting yourself to a multi-day hike is a breeze with the Platypus Gravityworks water filtration system. Weighing a mere 305 g grams and ultra-portable, it delivers 4 litres of filtered drinking water in just 2 1/2 minutes, no pumping required. Its Platy zip opening allows you to collect water easily, even in the most challenging of situations (think shallow muddy puddles). Its hollow fibre filter (pore size: 0,2 microns) effectively removes protozoa, bacteria and particulate. The filter cartridge, good for around 1 500 litres of the clean stuff, can also be back-flushed in four seconds to ensure optimal performance on the fly. The clean storage reservoir with shutoff clamp makes it easy to dispense what you've just filtered. Plus, if you fill up both bags, you have 8 litres to play with – making it an ideal solution for those hiking in larger groups. Price: about R1 700. Contact Outward Ventures on 021-683 3638 or visit www.outward.co.za



PLANETRON LED BAR LIGHTS ▲

See and be seen

Planetron's range of vehicle LED Bar Lights incorporate TIR (Total Internal Reflection) lenses to reportedly achieve 40 per cent higher optical efficiency than other light bars of similar wattage. Apart from longer throw, they also feature ETM (Electronic Thermal Management) technology to extend the lifespan of the LEDs to more than 60 000 hours without any dimming of brightness. Another plus: they boast an impressive IP68 waterproof rating. Prices range from about R2 300 (4 x 10 W Cree XM-L2 LEDs) up to around R10 000 (24 x 10 W Cree XM-L2 LEDs). Contact Planetron on 0861 752 638 or visit www.planetron.co.za



ULTIMATE HT713 OCTOCORE TABLET ▲

Made for business

In today's world, not keeping electronic tabs on the office while on the road can be business suicide. Small business owners wanting to up their game without blowing their budgets should check out Ultimate's HT713 Octocore tablet. Built with productivity in mind, it provides access to all the essential office tools such as email, word processing and spreadsheet capabilities. On a side note, it'll also keep you occupied watching your favourite series while killing time in the departure lounge.

Connectivity options include Bluetooth, Wi-Fi and 3G, with dual SIM support and backward compatibility to 2G when 3G isn't available. Its aluminium alloy chassis makes it a durable device for those on the move. It can also function as a phone and navigation device. Other features include a 175 mm capacitive multi-touch In-Plane Switching (IPS) screen, 16 GB on-board storage (expandable via Micro SD card), 1,7 GHz eight-core processor, 2 GB RAM and two cameras (2 MP up front for video conferencing and 8 MP at the rear). Price: about R2 400. Contact Drive Control Corporation on 011-201 8927 or visit www.drivecon.net



Part 2 of our 10-part series Motorsport Technology Down the Ages

From gentleman racers to the PlayStation generation

The year 1898 saw a dubious motor racing “first”, in the form of the first fatal accident: a Landry et Beyroux rolled, killing both the Marquis de Montaignac and his mechanic. The Marquis was one of the many examples of what would come to be known as the Gentleman Racer.

Early racers were often those entrepreneurs who wanted to showcase the abilities of the cars that bore their name – and to show off their driving abilities, too. Thus the early annals are littered with names such as Jenatzy, Serpollet, Stanley, Bentley and, yes, Ford.

Of course, racing was then, as now, a game for people with deep pockets and a zest for thrills and glory. As the moneyed set got in on the act, the starting grid began to feature the likes of Vanderbilt and members of the aristocracy.

It wasn't long, though, before the inherently perilous nature of the sport (particularly in its infancy) began thinning out the herd. Count Wolfgang von Trips and brewing heir Piers Courage are just two of the names that exited tragically before their time. Even so, specialised racing drivers began coming to the fore. Tazio Nuvolari and Bernd Rosemeyer epitomised the new breed of professionals backed up by vast, dedicated teams.

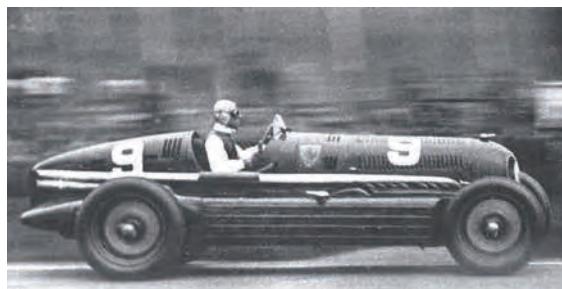
Yet the era of the amateur, the dashing privateer, the gentleman racer, was far from done. It's a concept that formed the bedrock of such marques as Ferrari, a tradition carried on today by that marque and similar exotica such as the Lamborghinis and McLarens of this world.

Predictably, among these well-off types there was an element of the eccentric. Count Gianni Marzotto, for instance, raced in his usual working attire – a jacket and tie – because he viewed driving fast as fun.

But it could be hard work, too. The 1923 Indianapolis 500 allowed single-seaters for the first time, and there were complaints about the bone-jarring ride quality of the smaller-engined, lighter, but slower cars with stiff suspensions. Although two-seaters and riding mechanics made a brief comeback at Indy, from 1925 they were banned in Grands Prix – yet the cars were still obliged to have two seats until the early 1930s.

Closer to the modern era, an element of those daredevil, less corporatised early days before big sponsorships remained even as Formula 1 took hold. But modern-day

Tazio Nuvolari epitomised the new breed of racer.



Count Wolfgang von Trips, seen here at the British Grand Prix in 1961, perished in a fiery crash at Monza.

racing is a whole lot more serious. Today, a racing driver can spend a full working day – and more – at the track, several times a week, bookended by early mornings at the gym and evenings at events and press conferences, generally providing a public face for the team. Actually *driving* can take up only a portion of daylight hours, given the time spent on optimising the set-up, briefings and debriefings.

And there's the impact of technology – not just in the cars, either: drivers use gaming consoles to gain familiarity with circuits and sharpen their reactions. One such programme is even used as a selection tool, with remarkable success apparently, to identify racing talent.

Race days are a huge PR exercise for teams, with everyone from sponsors and race organisers getting in on an act that starts early and finishes late. Post-race activities focus on more gym work, possibly more driving time and lengthy discussions with the technical team. Depending on the time of year, test driving may form an important component of these activities.

Some of the interest in this area is being driven by new-wave sports cars that look like road vehicles, but are in reality thinly disguised racers. You know the ones: McLaren P1 GTR, Ferrari FXX and Aston Martin Vulcan. All you need, really, is driving skill. And money, of course – lots of it.

THE GENTLEMAN'S CHOICE



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Not for Sale to Persons Under the Age of 18.

DOMO ARIGATO, MISTER ROBOTO

Contrary to what Elon Musk and Stephen Hawking believe, the machines are coming to save us. Robocop, Johnny Number 5, Chappie and Scarab all have our best interests at heart. Or at least that's what their creators are saying. Robots are kind of a big deal on the local front, so we investigated.

BY LINDSEY SCHUTTERS



Everyone in South Africa knows what a robot is. There's one on nearly every street corner and, when they go out, the country descends into a disturbingly dystopian state of mind, complete with gnashing of teeth. Quirky vernacular aside, we're a country of makers who lead the continent in the fields of robotics, automation and artificial intelligence.

Importantly, as witnessed on a visit to the University of Cape Town's Robotics and Agents Research Lab, we Saffers like to

make the whole product ourselves. "Most robotics labs buy their components off the shelf," says Tracy Booyens, who heads up the lab. "We buy in our electronics because no one is manufacturing semiconductors in South Africa. All our mechanical manufacturing and engineering is local."

What's particularly intriguing is the hardware focus at SA's premier robotics lab. You could fault the degree for not equipping the students with enough AI skills, but they're building operator-controlled drones that can take the

danger out of life-threatening jobs. And it takes manpower to build the bots and train the operators. They're on our side.

So is Chappie. The titular character in Neil Blomkamp's latest Hollywood outing is conscious, sentient and taking the place of police officers in dangerous situations. Okay, he isn't real, but the love affair with the human mind and making the world a better place for people is a sharp contrast to Messieurs Musk and Hawking's Skynet fears.

UCT ROBOTICS Page 32

SHARLTO COPLEY Page 34

→ **HEXAPOD, THE SIX-LEGGED FUSION OF LASER-CUT ALUMINIUM AND COMPLEX ELECTRONICS** on the table in front of me, has a bug. Ms Booyseন assures me that it was walking around perfectly fine yesterday and that the problem most likely lies with the third-party Xbox controller. I can believe her; those multifunction Bluetooth controllers can be hell to live with.

What's a big metal insect good for, anyway? "In theory, having six legs allows it to negotiate rough terrain by placing one leg at a time on whatever stable platform it can find," says Booyseন. "We can swap out two legs for tools without compromising mobility too much."

Speaking of which, Nasa has come up with a new idea for a Mars rover that uses wheels as well as legs. "When you're on nice flat ground, you cruise smoothly with the wheels," she continues. "But when you get to rougher stuff, then you lock up the wheels and climb using the legs."

Electrical components and sundry metal oddments litter every surface of the RARL lab. But there doesn't seem to be any closed-shoe policy, as evidenced by the student in the vest and *plakkies*. It's a chilled, creative environment devoid of Apple Macs. It's a varsity robotics lab and Hexapod looks like what you'd expect from such a birthplace. Sadly, it's the furthest from production. "It's a research platform so we can develop the artificial intelligence and control systems to use in other projects," explains Booyseন. "This product is for research modelling and won't make it to market."

Artificial intelligence in the case of operator-controlled robotics is less neural network and more data interpretation. The operator presses the Forward command and the robot interprets the command. It's almost how your phone is intelligent.

"A question we always get is 'Are you building robots to replace people?'" Booyseন explains. "If our robots go to market, you need people to build them, operators to control them and technicians to maintain them."

Of course, the RARL programme relies on funding to survive. A current research grant from the CSIR and NRF has the lab focusing on mine worker safety and recovery and underwater operations. That's the world of **Scarab**, a search-and-rescue robot equipped with a camera, speaker and microphone to locate and communicate with victims. Scarab evolved from the much larger track-driven Ratel, but is much more portable and manoeuvrable. Even more specialised is **Seahog**, a new third-generation submersible from the lab.



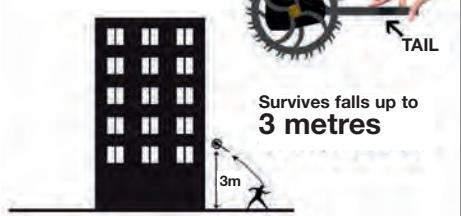
HEXAPOD



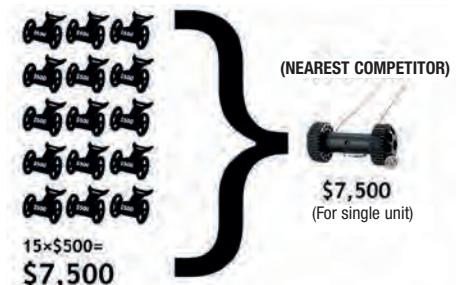
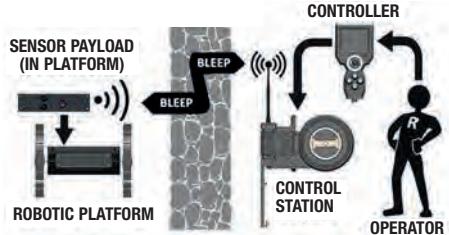
At a fraction of the cost of its nearest competitor, Scarab will be a market leader in search and rescue. It is intended as a money spinner in the mining sector.

SCARAB

THROWABLE
You can throw it



TETHER-LESS

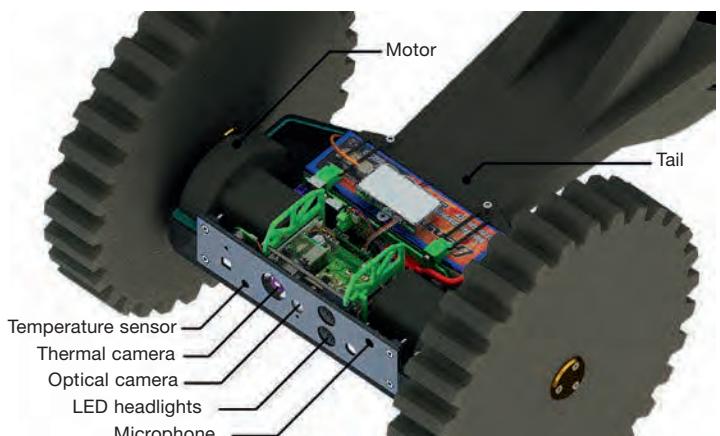


Operator control station:

- Lightweight and ergonomic
- Weatherproof
- Platform control and charging combined into a single unit
- Requires only one man to arm and deploy



Left: "Hexapod is a research platform so we can develop the artificial intelligence and control systems to use in other projects."



THE SEAHOG

3rd generation Remotely Operated Underwater Vehicle (ROV) for Marine Research Modular, scalable and upgradable subsystems. Isolation of subsystems to prevent large scale system failure in case of water ingress

SENSOR POD AND CONTROL

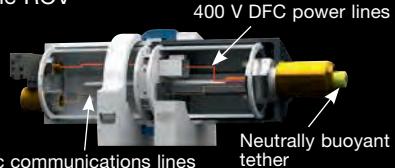
- Sensor payloads to be integrated later
- Depth and heading holding functions with auto-navigation a future goal

ELECTRONICS POD

- Power and communications to maximum 20 modules
- 2 x RS485 networks, 1 x RS232 network, 2 x video feeds, 1 x fibre-optic network
- Current monitoring and temperature feedback

JUNCTION BOX AND TETHER

- SAAB tether
- Delivers power and communications
- No tools required to disconnect the tether from the ROV



TIIT UNIT

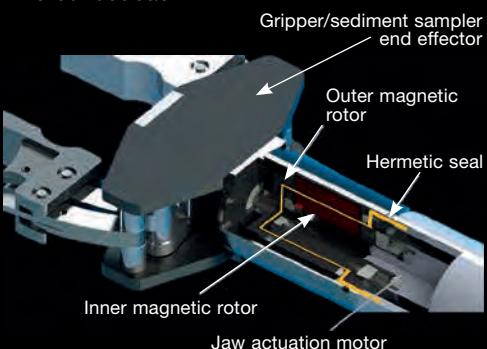
- Rotates camera and light
- Magnetic slip coupling
- Position and speed feedback

LIGHTS

- 2 100 lumen
- LEDs with brightness control
- Current and temperature feedback

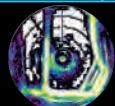
MANIPULATOR ARM

- Tilt unit rotates manipulator 90° to grip objects at various orientations
- Speed, position and current control allowing for precision movement and grip force feedback



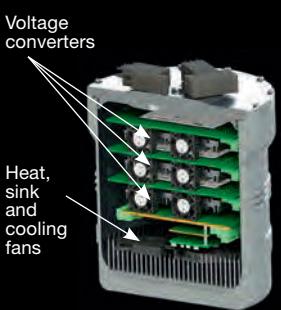
SONAR

- Micron Tritech sonar unit
- 150 m horizontal range



POWER POD

- Input 400VDC
- Outputs 48V, 15V, 12V, 5V.
- Voltage, current and temperature monitoring

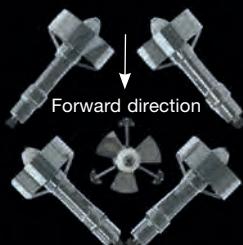


CAMERAS

- Live forward and rear video feed to surface
- Sony FCB EX45BP camera unit, auto focus and 18x zoom
- Domed lens
- Bosch VIP X2 video encoder
- Tether monitoring with rear camera

PROPELLION SYSTEM

- DOF: heave, surge, sway, yaw
- Co-axial magnetic coupling
- 48 V, 120 W, BLDC motor
- Dual core processor control board
- Closed loop speed control



GENERAL SPECIFICATIONS

- 300 m depth rating
- 75 kg mass
- RS485 communications network
- Fibre-optic tether





Sharlto Copley has known director Neill Blomkamp since he was 16.

MAN IN THE MACHINE

→ From South Africa's finest minds in the field of robotics to South Africa's finest robot mind. Sharlto Copley plays the title character Chappie in the upcoming Neill Blomkamp movie. Copley's performance as Chappie is a full motion-capture performance; he wore a grey suit with markers and was in every scene where Chappie exists, acting opposite actors or on his own. The animators, a team of about 200, then worked to CG animate over his every single movement in an incredible, highly technical process. He spoke to us about getting into the role and distinguishing the role from precursors such as Robocop. Chappie first graced YouTube in 2004 in a short film called *Tetra Vaal*, which is a similar story to how *District 9* evolved from 2005's *Alive in Joburg* (which starred and was produced by Sharlto Copley). We're sensing a trend and another smash hit for the dynamic duo, a good boost with the *Alien* franchise now on the horizon.

PM: WHAT DID YOU USE AS REFERENCE MATERIAL TO GET INTO THE MIND OF A SENTIENT ROBOT?

SC: We really wanted Chappie to feel as human as possible – basically starting like a baby and then developing super quickly to the emotional maturity of about a 10-year-old with a beyond-genius IQ. So I didn't focus on doing anything "robotic". I tried to play him more like some kind of genius human.

PM: HOW DO YOU STOP YOURSELF FROM PROJECTING YOUR PERSONALITY ON TO A CHARACTER THAT IS ESSENTIALLY A NEWBORN?

SC: There's really no big trick – you just act. (Laughs.) Actually, to be more accurate, in the case of Chappie you react. He's constantly observing and learning and listening, and he's developing from the information he gets. It was an incredible opportunity to just play a child – to leave my personality and mannerisms at home and pretend to be a kid. Getting paid to do it is an incredible bonus.

PM: IN THE TRAILER WE SEE CHAPPIE WATCHING *HE-MAN*. WHAT TV SHOWS WOULD YOU SAY HAD THE BIGGEST EFFECT ON YOU WHEN YOU WERE GROWING UP?

SC: My all-time favourite was *The A-Team*, so it was very surreal that I ended up playing Murdock in the *A-Team* movie. Some of those that had a real impact on me were *Family Ties*, *Knight Rider*, *Airwolf*, *Macgyver*, *The Lone Ranger* and later *Fawlty Towers*.

PM: DO YOU THINK ARTIFICIAL INTELLIGENCE WILL BE KIND TO HUMANS WHEN IT BECOMES WIDESPREAD?

SC: I hope so (laughs). I guess it depends how "emotional" the AI is and whether its intellectual side vastly dominates its emotions as we usually imagine would be the case. If, for example, it computed that the Earth was far too overly populated to sustain its current rate of development much longer, it may decide it needs to halve the human population. We definitely wouldn't see this as kind, but an AI lifeform might. It might argue it's doing what is logically the "kind" thing to do for humans and the planet in the long term.

PM: THIS IS YOUR THIRD HOLLYWOOD SCALE SCI-FI OUTING WITH NEILL BLOMKAMP. WHAT MAKES HIM SUCH A GOOD SCI-FI DIRECTOR?

SC: Neill often describes himself as a "visual artist" first and a director second. He's also one of the most intelligent people I know in terms of raw IQ-style intelligence, and he has a massive

interest in what's going on in the world around him. I think those elements in combination are what make him amazing at sci-fi. I knew him when he was 16, and even at that age he was designing sci-fi elements in 3D animation, like robots or spaceship control rooms, where just his images elicited some kind of emotion. Ridley and Tony Scott once referred to his work as "soulful sci-fi" and I think that's spot on. He is interested in where the world is headed and applies himself intellectually to those questions. So, for example, in *Blade Runner*, the world Ridley presents is what Los Angeles looks like in the future. Neill argues, no, it's going to look like Mexico. So we shoot Mexico for LA in the future in *Elysium*. I think most futurists would actually agree with Neill. LA will most likely end up looking like Mexico for many many years before it gets close to looking how it does in *Blade Runner*. But trying to argue his version of the future isn't his primary focus. He loves to use sci-fi as an entertaining, satirical metaphor for issues that people around the world are facing right now, and for me that is the true genius in his work.

PM: WHERE DOES CHAPPIE FALL BETWEEN JOHNNY FIVE AND ROBOCOP? OR ISN'T THERE A COMPARISON TO BE MADE?

SC: I can understand why people might want to make a comparison; there are definitely some nostalgic nods to those classic movies. In fact, I think anybody who grew up with 80s movies is likely to find much nostalgia in the way the film is made, but it's a truly original piece of work. Chappie himself is a child-like robot who becomes a gangster. He has positive and negative parental role models in his life who are both trying to influence him and he has to learn to make his own decisions. There's really never been a robot like this before.

PM: IN WHICH ROLES DO YOU THINK SENTIENT ROBOTS WILL BE THE MOST USEFUL TO HUMANS?

SC: I think if a robot was truly sentient it wouldn't be a question of how they would be useful to us. It would be a question of if we had any use to them.

PM: BEING SOUTH AFRICAN YOURSELF, ARE YOU COMFORTABLE WITH EXPLOITING THE INEQUALITIES IN SA CULTURE THAT ARE REFLECTED IN NEILL BLOMKAMP MOVIES? IN YOUR EXPERIENCE, ARE THESE INEQUALITIES AND SOCIETAL SHORTCOMINGS UNIQUE TO SA?

SC: I think it's inaccurate to say that films and characters inspired by



one's upbringing and experiences in South Africa are exploiting inequalities. A major function of artists in society is to reflect issues that society is wrestling with back to itself. When I played Wikus for example, I was reflecting, in a sense, a metaphor of what white South Africans did in this country – that is, they eventually let go of their fears and prejudices and tried to do the "right thing". Contrast that with the actions of our current government leadership, who are so obviously exploiting the underprivileged and uneducated people of this country to fill their own coffers. I think a filmmaker like Neill is reflecting aspects of society that people face in every country around the world. In my experience, massive inequality and a sense of wanting to live and mix with "your own kind" – these are things you see in every country and city around the world if you look. They are major challenges that the world is going to face for many years to come and there are no easy answers.

PM: DO YOU PREFER PLAYING THE ROLE OF A GOOD GUY OR A BAD GUY? WHY?

SC: I definitely prefer playing "good guys" – or at least flawed people who ultimately allow their light/good to shine through in the actions that really count. I find play-



Chappie was scheduled to appear in cinemas across the country from 13 March 2015.

ing villains extremely draining on me personally and don't plan to do many more villains in the future because of that.

PM: SCI-FI WRITERS ARE SOMETIMES SEEN AS BEING QUITE PROPHETIC. WHAT ARE YOUR THOUGHTS ON HOW SCI-FI SHAPES OUR IMAGINATIONS?

SC: I found growing up and watching sci-fi opened my mind and freed my imagination. I think that is one of its biggest benefits: instilling the idea that anything might be possible. Really intelligently-written sci-fi might opt to give you a specific version of what the future might be like, but that's only entertaining if you can relate to the world and the characters.

PM: DID YOU READ SCI-FI GROWING UP? WHAT WERE YOUR FAVOURITE STORIES?

SC: No, I didn't. As a young child I loved the Peter Rabbit stories and Enid Blyton books. I

read fantasy/adventure stuff like *The Hobbit* and I loved crazy humour like *Mad* magazine, which I read a lot as a teenager. I watched a lot of sci-fi films – two of my favourites are the first two *Terminator* and first two *Alien* films.

PM: IS THERE A MESSAGE YOU WERE TRYING TO BRING ACROSS THROUGH CHAPPIE? WHAT WAS IT?

SC: One of Neill's notes while making the film was that AI is as valid, if not more so, than human intelligence. Within that, my function really as the actor was to make sure that people would care about and empathise with Chappie. Hopefully I've done that.

PM

● READER COMPETITION ●

WIN a Uniway valued at R7 999

What is the Uniway? A Uniway is fun transportation experience – some might call it a single-axis self-balancing inverted pendulum unicycle. We like to call it pure awesome. Wind in your hair kinda awesome.

How does it work? Simply step on the foot pads and lean forwards (or backwards if you prefer to revisit places) and the rest is history!

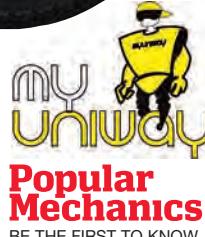
The Uniway moves thanks to the brushless DC motor, the battery and the gyro-stabilised system. It detects the forward tilt and instructs the engine to compensate for the balance by rotating the wheel and by keeping the tilt stable. When braking, it reciprocally detects the backward tilt and order the engine to decelerate. How cool is that?

Does it require special skills, you may be wondering? We like to believe that, if you can learn to ride a bicycle, a horse or a car, you can learn to ride a Uniway. No acrobatic skills are required.

The Uniway weighs 9,8 kg, can handle up to 120 kg of pure human awesomeness and can reach speeds of up to 16 km/h.

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SMS the word **Uniway**, followed by your colour combination, your name and email address to 32697 (R1,50 per SMS; this service does not allow for 8ta numbers). To enter online and see the rules visit our Web site at www.popularmechanics.co.za Competition closes 30 April 2015 and winners will be drawn on 4 May 2015.

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150 years

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THE Popular Mechanics Guide TO WATCHES

Watches are extraordinary things. Feats of engineering you can strap to your wrist. Whether you choose mechanical or quartz, traditional or smart, your watch has an important role: it lets people know who you are. Even if that's just a guy who wants to know the time without reaching into his pocket.

The last American watchmaker

THE GREATEST TIMEPIECES IN THE WORLD COME FROM SWITZERLAND. AND RURAL USA.

By **Josh Ozersky**

Photographs by Rainer Hosch

ON THE CORNER OF A NONDESCRIPT

block in Lancaster County, Pennsylvania, is a bank, or what used to be a bank. Now it is the home of Roland G Murphy Watch Company, the USA's only truly independent elite watchmaker. Inside, the titular Murphy's son-in-law, Adam Robertson, is bent over an old watchmaker's drill press that looks like it was made during the Korean War. He uses an abrasive bit to create burnished, circular perlage on the underside of the main plate of the watch movement. He is focused and unmoving, his attention riveted to the plate, whose decoration no one will ever see. Later he'll hand-polish the bevels of screw holes on the tiny bridge that holds the wheel-train gears in place.

High-end watchmaking has not, for the most part, always been something you find in Amish country. Or, for that matter, in the United States. Typically, if you

go looking for horological greatness, the kind of virtuosic craftsmanship associated with the greatest watchmakers, you go to Switzerland. If you are looking for scrap-ple, you go to Pennsylvania. But Murphy, the 53-year-old owner and sole proprietor of the watchmaking company that bears his name, is the exception. Like some of the small European companies directed by a single watchmaker, RGM makes fewer than 300 watches a year. In contrast, the brands worshipped by most enthusiasts – Patek Philippe or Vacheron Constantin – produce tens of thousands a year. Rolex produces 2 000 a day.

Of course, Rolex doesn't operate in a space that looks more like a masonic lodge than a watch manufacturer, with a collection of vintage cameras filling shelf after shelf, along with various other mementos. But then Murphy himself doesn't fit the bill of a classic watchmaker. Burly and with a thick head of salt-and-pepper hair and a bushy moustache to match, he looks more like a juniors rugby coach. Like most watchmakers, he started out doing repairs and found himself drawn to the silent, obsessive work of creating tiny universes of absolute order. After a few years of working on clocks, he found his way to Switzerland, where he made the horological equivalent of the leap into the big leagues: training at the



Clockwise from above: Roland Murphy peers through a rose-engine machine – an intricate engraving tool – during set-up for the carving of geometric designs in his watch's dials; the solid-silver dial on the rose engine; the craftsman works in front of a vault in the old bank building that houses his business; a look at the bridges on the main plate of the RGM 801 model watch.



Watchmakers of Switzerland Training and Education Programme, the Swiss watch industry's official certification programme in Neuchâtel. Not long afterward Murphy landed at Hamilton Watch Company, where he eventually rose to an executive development position.

Hamilton, it ought to be noted, is a famous American watch brand. But the dirty secret of nearly all American watch brands, Murphy's excepted, is that they



are either owned by the Swatch Group outright or utilise movements built and exported by one of its subsidiaries. Most of the American watch companies you've heard about are using Swiss movements and Chinese casings. And none even tries to produce the kind of arcane complications – a whirling tourbillon that compensates for gravity, say, or a precision Moon-phase subdial – associated with the Patek Philippe and Jaeger-LeCoultres of the

world. RGM makes what are by far the most intricate and ambitious timepieces produced in the United States. But they aren't just clones of Swiss watches either. They're inspired by the tough, durable railroad watches of industrial America.

The paradox, of course, is that this rugged practicality is actually pure poetry.

A R600 Casio G-Shock keeps more accurate time than a Breguet; a hot-pink Swatch a fourth-grader wears in the pool is more reliable than a watch that costs more than her home. When you think about it, there's no reason for anyone to create in-house movements for an American watch. Murphy's quixotic commitment to craftsmanship has no value to anyone but an equally idealistic buyer.

Nowhere is this clearer than in Murphy's masterpiece, the Pennsylvania Tourbillon.



A mechanical watch, no matter how perfectly made, is affected slightly by gravity. The rhythm of its escapement, the part of the movement that regulates timekeeping, varies slightly based on how the watch is positioned. Not that anybody other than watchmakers would care or even notice. But the gravity problem stymied them, and so in 1801, Abraham-Louis Breguet patented a rotating cage to suspend the

escapement, freeing it from the effects of gravity.

Manufacturing a tourbillon is incredibly hard, which is why almost nobody does it. It's also why two or three guys doing it in a Pennsylvania bank building borders on the fantastic.

Two bridges hold the tourbillon cage in place. Murphy and his master watchmaker, Benoît Barbé, bore tiny holes in the bridges to mount the escape wheel, pallet and balance. They friction-fit a gold ring inside each hole and a jewel into each ring. The 90-degree angle of the drilling, the depth of the holes, and the ring-and-jewel fittings must be precise to ensure the perfect relative positioning of the parts. The slightest variation would ruin the mechanism.

The completed tourbillon turns 360 degrees once per minute, driven by a tiny spring coiled around the central axis. All of this work, by the way, can be done only by hand. A few of the parts can be machined, but even those parts are usually made by equipment the two men created themselves.

Murphy doesn't build watches for himself or his buyer. He builds for an ideal: that things should always be better than what's necessary. "We don't design on the limit," Murphy says. "Think about the Brooklyn Bridge. How much weight do you think it had to bear when they built it? Some horse carriages? Some pedestrians? Today there are giant trucks going over it all day, and it supports that weight because it wasn't designed to the limit. That's something we take pride in." And it's something you won't find anywhere else in America.



WATCHES THAT CAN TAKE A BEATING



The watch: MTM Silver Patriot (R5 800)

The wearer: **Albert Vargas**, Los Angeles Fire Department

The evidence: "The Patriot takes constant abuse. There have been times when I've hit it pretty hard with forcible-entry tools or the four-inch hose. It gets bumped when I'm carrying the SCBA, our breathing apparatus. It's been exposed to house fires hotter than 1 200 degrees."



The watch: Luminox Navy Seal Chronograph (R4 050)

The wearer: **Pat LaFrieda**, butcher

The evidence: "It's gotten soaked in blood. It's slammed against bone in production and bounced off wooden pallets in distribution. I wore it hunting in 10-degree weather. I had it on when I flipped my Polaris Sportsman 500 quad off a ridge. Still ticking."



The watch: Casio G-Shock G2310R-1 (R3 000)

The wearer: **Mark Clement**, contractor; co-host of *My Fixit Up Life*

The evidence: "I've raked the band across flooring during installations, rattled it digging postholes for decks. The most brutal beating was last winter, when it was below freezing. I was ploughing snow, running a mitre saw, and roofing. My phone battery fried, but my G-Shock never flinched."



An appreciation THE CHEAP CASIO

It took two weeks of searching to find my first serious watch, a tide-reading, GPS-enabled timepiece that, for R5 000, would make me punctual and a better surfer. After adding it to my online shopping cart, I asked a friend, a savvy waterman in Hawaii, what he wore: "Cheap Casio". No mention of any special features – he just appreciated its function. So I ordered one of those instead.

Three months in and the W800H-1AV sits on the short list of near-perfect devices I've used. The digits are big enough to see the time and date with a quick glance. Its body is thick enough to find the LED light button, even with motorcycle gloves on, yet it still fits underneath a shirt cuff. I actually like it best with a suit – I'm in awe of the engineering wonders of more expensive watches, but the kitsch of a digital watch with a resin strap feels appropriately irreverent. With its 10-year battery and water resistance to 100 m, I'll probably lose the watch before it breaks. Fortunately, it won't take two weeks to decide on a replacement.

– ALEXANDER GEORGE

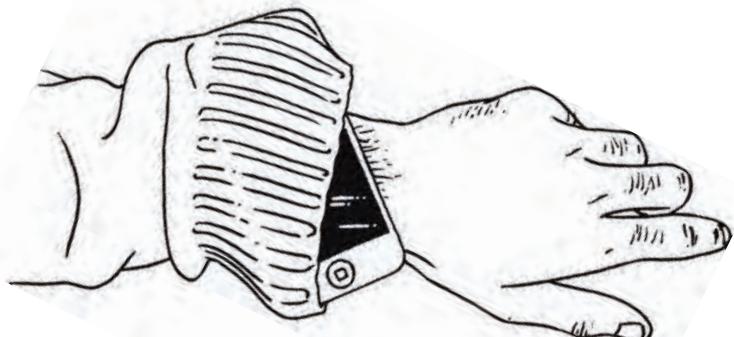
IF WE MAY...

Your phone is not a watch

For generations, if you asked a man the time, he'd snap his arm out to full length so the cuff of his shirt pulled back a little, then bend his arm at the elbow and glance down at the watch on his wrist. "Quarter to four," he'd say. The whole thing took about a second. Here, too often, is what he does now: he shoves his hand into his pants pocket, or into the folds of the suit jacket beneath his overcoat, fishing for his telephone, which he produces and holds in front of his face. Then he pushes the button and the time pops up on the screen and he says, "Three forty-six."

This is no way to tell time. It's inefficient. It wastes time, which is the thing you're worried about in the first place – otherwise you wouldn't need to know what time it is. Plus, it's inelegant. A man without a watch looks unprepared, like a man who has to check his wallet to see whether he has any cash. A man should always have cash.

Your phone tells the time, yes, but your phone is not a watch. You need a watch.



The complications

THE SMALLEST DETAILS CAN MAKE THE BIGGEST DIFFERENCE.



MINUTE REPEATER

A holdover from the pocket watch, repeaters have a lever on the side that, when flipped, activates tiny hammers that hit differently pitched gongs. Three tones, from low to high, signify each hour, quarter-hour, and minute, respectively. Minute repeaters often cost six figures due to the complexity of installing the many gears.

Example: Audemars Piguet Minute Repeater

PERPETUAL CALENDAR

Mechanical watches with annual calendars must be reset three times every four years. (They count 29 days each February to account for leap years.) A perpetual calendar, however, accounts for leap years only when they happen, requiring correction just once every hundred years, since each new century not evenly divisible by 400 (2100, 2200, etc) does not contain a leap year. **Example:** Jaeger-LeCoultre Master

WHEN WILL YOU GET A SMART WATCH?

Give yourself two points for each attribute you possess, then check your results.

- You own a watch.
- You own a smartphone.
- You own more than one smartphone.
- You see no problem in owning more than one smartphone.
- You own a Smart lightbulb.
- You can programme a PVR.
- You have a 4K TV.
- You prefer the Jetsons to the Bradys.
- You have referred to yourself, proudly, as an early adopter.
- You've stood in line for a smartphone.
- You have a friend with a smart watch.

- You've never made fun of that friend.
- You feel anxiety when your phone is more than two metres from you.
- You do not need a manual to pair a Bluetooth device.
- You can reset your own Wi-Fi router.
- You don't mind dictating text to a phone or computer.
- You love getting email.
- You have to respond to a text within one minute of receiving it.
- You do not need reading glasses.
- You have used a pedometer.

- You've considered buying Google Glass.
- You get Battlestar Galactica jokes.
- You make Battlestar Galactica jokes.
- You can write code.

ANSWER KEY

0-20. You are at least a year from buying a smart watch.

21-40. All it'll take to persuade you is one more friend with a good experience.

40 or more. You may already be wearing a smart watch.

THREE GOOD OPTIONS



1. Apple Watch
Accelerometers integrate with iOS workout apps to make it a practical fitness tracker. Curved touchscreen and zoom-and-scroll crown are Apple beautiful.
Downside: Needs daily recharge.



2. LG G Watch R
Notched bezel provides a vintage aviator feel as you cycle through texts, weather updates, and calendar appointments.
Downside: Chunky and slightly conspicuous.



3. Garmin Vivoactive
Adds smart-watch functionality to Garmin's existing and excellent fitness trackers. Waterproof to 50 m and has GPS, so you can track your run, bike ride, or swim.
Downside: Poor battery life in GPS mode.



MOON PHASE

Originally used by sailors to track tides, the Moon phase, which shows the visible portion of the moon, is now just an aesthetic element. It works by adding a dedicated gear that completes one rotation every twenty-nine and a half days, the length of a lunar cycle. **Example:** Baume & Mercier Clifton

TOURBILLON

Although not technically a complication, there is no more beautiful feature for your wrist. Or more superfluous. Invented to prevent timing fluctuations caused by a pocket watch's static vertical orientation, a tourbillon holds the escapement in a rotating cage, offsetting gravity's negative effects. This is no longer an issue, since a watch moves with your wrist. **Example:** Breguet Classique Tourbillon

FLYBACK

Chronographs require three presses of the trigger to stop, reset and restart the timer. With a spring attached to the running wheel, a flyback returns the counting hand to twelve o'clock with one push and almost instantly begins counting again. The function was created for pilots timing turns while flying in formation, where a fraction of a second counts. **Example:** Tudor Grantour Chrono Fly-Back

KNOW YOUR MOVEMENTS

What makes your watch work.

QUARTZ

A battery sends an electric current to a tiny, tuning-fork-shaped piece of quartz, causing it to oscillate at 32,768 vibrations per second. The watch's circuits reduce that number to one vibration per second, or one hertz, and those pulses are translated into ticks by a tiny electric motor. (This is why mechanical watches, whose springs steadily release tension, have smoother second-hand movement than quartz watches.) Quartz's indifference to temperature fluctuations makes it well suited for harsh conditions.

MECHANICAL

A balance, or wheel, moves according to the energy expended by the tightly wound spring that powers the watch. On manual-wind watches, that energy comes from regularly turning the exterior crown to apply tension to the spring. Automatic, or self-winding, watches have a semicircular weight that pivots as your arm moves, turning the gears that wind the main spring.

HOW TO... CHOOSE A STRAP

The benefits and drawbacks of rubber, fabric, metal, and leather.

RUBBER

PRO: Casual, comfortable, washable (with a little soap and water), waterproof.
CON: Inappropriate in most formal settings.

METAL

PRO: Durable, formal, shiny, sometimes interesting from an engineering standpoint (see below).
CON: Occasionally pulls out arm hairs.

MORE ON THIS WATCHBAND: The MTM Special Ops Trigger uses a first-of-its-kind bracelet linked with ball bearings instead of pins, making the band much more flexible for a closer fit and no more pinched skin. The face, too, is impressively engineered: if you know you're going to be banging the watch around, you can rotate the bezel to raise it slightly to protect the crystal.



FABRIC

PRO: Casual, comfortable, washable, easy to swap out.
CON: Has a relatively short life span, could lead you to consider matching your watchband to your clothing.

LEATHER

PRO: Classic, formal, elegant, safe. Smells nice.
CON: If you are prone to perspiration, that nice smell can be replaced with a pretty terrible one.

circa 3500 BC

The sundial is invented. Not that anyone really had anywhere to be.



1953

Blancpain's Fifty Fathoms introduces a unidirectional rotating bezel – the outer ring that divers use to monitor remaining air – so that, if the bezel is bumped, the biggest threat to the diver is surfacing with more air than he expects.



2015

Filson partners with Shinola, expanding the classic field-wear company to include its first line of wristwear.

Great moments in watchmaking history

1850s and '60s

The first American watch companies, like Waltham Watch Company, Elgin National Watch Company, and E. Howard & Co., are established near Boston and in Illinois.



1914

Radioactive radium paint is used to make watch hands glow in the dark. After clients and employees lose teeth and develop cancer, the radium is eventually replaced by safe photoluminescent materials such as zinc sulfide and strontium aluminate.



1940

IWC Schaffhausen introduces the Big Pilot's Watch, designed with a large onion crown (now IWC's signature) that allowed pilots to adjust their watches without removing their gloves.



1926

The Rolex Oyster becomes the first water-resistant watch after the free-spinning crown is replaced by a threaded crown, allowing it to screw in to the case.

1917

Louis Cartier creates the signature Tank watch, modelled on the aerial silhouette of the Renault tanks he saw while fighting for the French during World War I.



1960s

Deep-sea divers discover that helium atoms can leak into watches, building up pressure and cracking the crystal. In response, brands such as Doxa create escape valves – automatic, one-way valves that release pressure as the diver surfaces.

1970

The first digital watch, the Pulsar, is released by the Hamilton Watch Company.



2014

Bathys Hawaii Cesium 133, the first self-contained atomic clock – and thus the only perfect timekeeper – debuts.

2012

The Pebble smart watch sells out before it's even introduced.



2011

Shinola opens in Detroit, delivering manufacturing jobs back to a city that needs and deserves them – and beautiful, accessible American watches to the rest of us. **PM**

PM TESTED



COMPACT BICYCLES

Rolling on twenties

A bicycle can fix everything. Obesity? Get on a bike. Stress? Ride to and from work. Flu? Riding will improve your immune system. Unemployed? Have you heard of bike messengers? The bicycle is the solution, but science and Strava have ruined it. You didn't care about who was king of the mountain when you were 12, it was only about getting around quicker. And that 12-year-old probably rode a low-maintenance, rugged and inherently cool BMX.

While the MTB wheel debate has largely settled on 27.5" as the best trade-off between speed and comfort, it's an awkward wheel size to smuggle on a train or take on the bus. If you need to take another form of transport between bike rides then the compact frame geometries that accommodate 20" wheels are best. This leaves regular and larger-sized people with the circus bear conundrum of either getting an awesome-when-I-was-12 BMX or a ridiculous-looking fold-up.

The BMX wins on cool factor and fat tyre comfort, but the fold-ups roll quicker and usually come with sweat-beating gears. We've measured three 20" steeds on a 5 km train station to office route and these were our findings:



Dahon Vybe C7

FRAME: Double-butted aerospace grade aluminium

FORK: Dahon patented fusion technology

RIMS: single-wall alloy

TYRES: 20x1.5"

WEIGHT: 11 kg

POSITIVES: Good gearing

NEGATIVES: Harsh ride

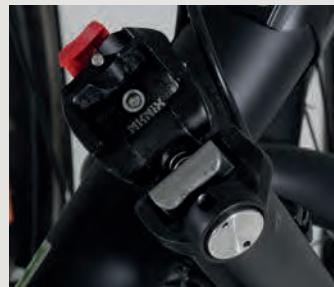
PRICE: R6 000

TEST NOTES: Seven speeds and skinny tyres helped the Dahon surge to the finish line as the fastest bike, but the 15-second fold time lost it some points. All the goodness of the compact fold is also offset by the greasy chain and easy-to-damage derailleur. Still a great bike from the worldwide leader in fold-up bicycles.



**B'Twin Tilt 7**

FRAME: 6061 aluminium
FORK: 6061 aluminium
RIMS: single-wall aluminium
TYRES: 20x1,95"
WEIGHT: 13,5kg
POSITIVES: Well thought-out design
NEGATIVES: Not the most compact fold
PRICE: £480

**Mongoose Subject**

FRAME: Butted high-tensile steel
FORK: high-tensile steel
RIMS: double-wall aluminium
TYRES: 20x2"
WEIGHT: 12 kg
POSITIVES: Built like a tank
NEGATIVES: Cramped riding style
PRICE: R3 000

TEST NOTES: If an adult decides to ride a BMX it becomes a commitment. Choose between knee pain from sitting down with your thighs coming up to your ears or get a full body workout by standing up. The Mongoose was great for hopping on and off pavements and comfortably rolled over any obstacle, but it did partially block the walkway and the micro gears (25:9) spin out at around 20km/h. This is also one of the lightest steel frames on the market.

CONCLUSION:

It's horses for courses, really. If you live close (>3 km) to the office and have no hills then get a BMX; it'll be fun and make you strong. For train/bus commuters the clean drivetrain on the Tilt 7 is your weapon of choice. Serious bike commuters who like to trek for miles should consider the Dahon. There are plenty of fold-up choices out there and none of them are poor.



INTRODUCING: LEATHERMAN LEAP

The first Leatherman multi-tool created specifically for younger users. Our engineers designed the Leap with safety as our #1 priority. That's why the Leap includes safety locks that keep fingers from the path of the tools, a two-hand opening knife blade for safer deployment, and a secure grip designed to train users to properly and safely operate tools. The Leap also comes with a user-installed knife blade that can be added by a parent when the user is ready for more responsibility.

- For ages 9 and up.

LEAP®

13
tools



1 Needlenose Pliers
4 Hard-wire Cutters
7 Saw
10 Medium Screwdriver
13 Small Screwdriver

2 Regular Pliers
5 Ruler
8 Spring-action Scissors
11 Bottle Opener

3 Wire Cutters
6 Phillips Screwdriver
9 420HC Knife
12 Tweezers



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INTRODUCING: THE FIGHTER JETS OF FLASHLIGHTS!

F1



F1 WHITE



F1R



	F1	F1 WHITE	F1R
Luminous flux *	400 lm	500 lm	1000 lm
Burning Life**	2 h	3.5 h	60 h
Beam Distance*	100 m	100 m	160 m
Batteries	1 x CR 123A 3V	1 x CR 123A 3V	1 x CR 18650 3.7V

* Luminous flux (lumens) and max beam distance (meters) are measured when switching on with new set of fresh batteries. ** Average hours of burning life as measured in the least energy-consuming mode and until residual luminous flux amounts to 1 lumen.

LED LENSER®

Creating New Worlds of Light

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DISASTER LEVEL:



STABLE

Page 52



WORSENING

Page 57



APOCALYPTIC

Page 59

Hard-core tips, preparatory advice, and illuminating insights
for the somewhat concerned.

PHOTOGRAPHS BY IAN ALLEN • TYPOGRAPHY BY ISTVÁN SZUGYICZKY



EXPERT

NATE BECKER

Dog Musher, Eagle, Alaska

After spending his twenties and early thirties as a firefighter and paramedic in Wyoming and, later, for the National Park Service in the Grand Canyon, Becker moved to Eagle – a town with a population of 86 – in 2008 to lead dog-sledding trips in the backcountry with Bush Alaska Expeditions. Here, he shares his survival rules. Clearly, some of them are more appropriate to extreme, icy conditions – just like the ones you're likely to encounter on a bad weekend in the Berg...





↑

On the trail
Becker prefers to wear gloves under his mittens, because "you can take a gloved hand out of a mitt and do something like chop wood or set a trap".

GEAR

Always take a sleeping bag. You never know when you'll get stuck out and have to spend the night or just need a quick warm-up. And I bring a preassembled emergency pack. Right on top is a pair of warm mitts in a ziplock bag. History is riddled with stories of people who didn't survive because their hands froze. You can walk a thousand miles on frozen feet, but you can't survive six hours with frozen hands.

Also in my pack are blankets, hand warmers, a big survival knife, signalling devices, fire-starting equipment – you can't have enough fire starter. One thing I absolutely won't be without is a Leatherman. I carry two. And then there's a fur ruff, which lines the hood of your parka. Even the stiffest wind has a hard time penetrating a ruff. Just make sure it's real fur.

TRAVEL

The easiest travel is on frozen rivers and creeks, because the land is usually choked with brush and trees. But remember that the ice is dangerous. You have to know the difference between good ice and bad. Clear is bad. You want cloudy. And

you want cracks. Once ice gets thick, the water expands as it freezes. It has to give somewhere, so the ice cracks. When you see cracks in cloudy ice, it's almost always safe.

SETTING UP CAMP

For me the number one priority is easy water. You can almost always find enough firewood. But it takes a lot of time and energy to melt enough snow into water for 20 dogs. To find the water, just listen for it. When I get to a spot that looks like it might have water, I'll put my ear down and listen. If I can hear the water, I can get to it. If I can't hear it – because it's under a couple of metres of snow and another layer of ice – I move on.

If it's a true emergency, don't worry about trying to build the shelters you see in survival books. You would never have time to build most of them. As long as you've got a sleeping bag, the best and the quickest shelter you could make would be to sandwich yourself with your sleeping bag inside a tarp, kinda like a burrito, and then figure out some way to cover yourself with snow for insulation. When it's 50 below and the snow temperature

is only minus 30, that 20 degrees makes a difference.

TRAPPING

If you can, set traps every half a kilometre to a kilometre. In Alaska, a lot of us catch marten using small leg-hold traps, which are those spring-loaded metal jaws. To set the trap up, first find a 3-metre, small-diameter tree, preferably a dead one. Then tie it to a big tree at a 45-degree angle from the ground. On the end of that pole you hang bait or a lure or both. A lot of times we'll use a visual attractor like a feather or something shiny. Bait can be guts from other animals or even a piece of hide. Once you secure the trap to the spruce tree just in front of the bait, open it. The idea is to get the little bird to climb the pole and step in the trap.

STAYING DRY

Don't work up a sweat. If I find myself exerting a lot of energy, the first things off are my hat and neck gaiter to promote cooling. It is far better to stay a little chilly (knowing I can put clothes back on to warm up) than to let yourself perspire. Moisture lessens the insulating value of your gear, and even the best moisture-wicking fabric in the world won't eliminate sweat. Once you get wet, you stay wet until you get to the cabin or tent at night to dry out.

RESCUE

I always carry high-visibility material in neon orange or green. This comes from my days working on a helicopter crew as a paramedic. It's easy to miss someone from the air, so you want to make yourself as visible as possible. That means movement and contrast. A signal flare works, obviously. But neon material called flagging can be tied to a tree. Then, if a pilot flies over, he can see you and which way the wind is blowing. That helps him if he's going to come in and land to get you out.

– as told to Peter Martin

PREPPER JARGON DECODER

BOB: Bug-out bag. The essential escape kit in case of emergency. → **GENNY:** Generator.



PREPPING LITE

What preppers do, and what you, a slightly less paranoid citizen, can do.

- Prepper
- Casual survivalist

COMMUNICATION

Establish a dead drop – a secret place to deposit and retrieve messages when communications go down. Tell only trusted confidants about this place.

Get your ham-radio licence. Plenty of people still use ham radios to communicate, including FEMA. In a catastrophe, it might be your only option.

HEALTH

A properly equipped go bag, or bug-out bag, is heavy. Establish a training regimen on various terrains, so that you can flee without getting winded.

Pick up a fitness tracker. In a low-food situation, it'll track your vitals and even count your calories. In the meantime, you'll just be healthier.

FOOD

Practise hunting the animals native to your area. Worth noting: domesticated rabbits are less gamey than their wild counterparts.

Non-food items you should have in your emergency pantry: manual tin opener, multivitamins, fuel gel (for cooking).

SHELTER

Build an underground bunker. Ideally, for ultimate secrecy, not on your house property. But that might also require a rather large purchase.

Have a list of emergency shelters. They should be accessible and sturdy – a public shelter, a church, a neighbouring building's basement, which (if it houses a pub) hopefully has a pool table.

HEAT

If the power goes out, a wood stove is great backup.

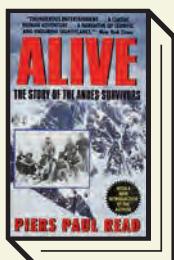
Store a couple of ceramic flowerpots in the cupboard. Two pots nested, turned upside down, and propped above a few candles make an effective space heater.

WATER

Capacity of your cistern equals (5 litres per person) times (number of people) times (number of days of expected cataclysm) times (10 – just to be safe).

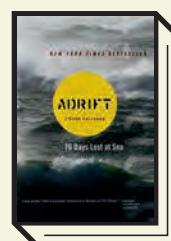
Keep a large water-filter pitcher in your fridge. Good for everyday use and as a filtration system. At the first sign of trouble, fill all extra containers and the bathtub.

THE ESSENTIAL SURVIVAL BOOKSHELF



ALIVE: The Story of the Andes Survivors, by Piers Paul Read

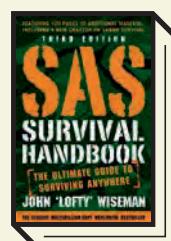
"The last discovery in their search for new tastes and new sources of food were the brains of the bodies which they had hitherto discarded. Canessa had told them that, while they might not be of particular nutritional value, they contained glucose, which would give them energy; he had been the first to take a head, cut the skin across the forehead, pull back the scalp, and crack open the skull with an axe. The brains were then either divided up and eaten while still frozen or used to make the sauce for a stew."



ADRIFT: 76 Days

Lost at Sea, by Steven Callahan

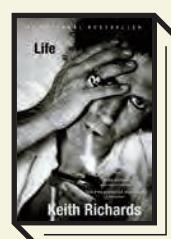
Because if you have common sense, a little general knowledge, and a lot of fear, you can survive anything. And because he punches sharks in the face.



SAS SURVIVAL HANDBOOK

by John "Lofty" Wiseman

Everything you need to know.



LIFE, by Keith Richards

DOOMER: Someone who thinks total chaos and collapse will follow the oil supply falling short. → **TEOTWAWKI:** The end of the world as we know it. Probably easier

modo

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Naked and Afraid is the best survival show

Everyone else is just playing.
BY DAVID CURCURITO

BEAR GRYLLS IS A WUSS. Les Stroud (you may know him as *Survivorman*) is just camping. Mick Dodge – well, that guy is pretty badass, but he's a barefoot lunatic. And almost all of the other hundred survival shows aren't actually about surviving, they're about living in a warm home deep in the woods (I'm talking to you, *Alaska: The Last Frontier*).

The Discovery Channel is the only one that gets survival TV right, with its simple, genius *Naked and Afraid*. Two complete strangers, a man and a woman, meet completely naked – without food or water – in a desert, swamp or forest. Then they walk the Earth like God intended for a harrowing 21 days. Yes, it's the same damn show every episode: the two people get along, build a shelter, struggle to make a fire, and then starve while eating an occasional snake or dead bird. Or: the two people hate each other, build a shelter, struggle to make a fire, and then starve while eating an occasional snake or dead bird.

But my fascination with the show isn't about skills or gender roles. What's entertaining is watching people come close to death from exposure and starvation. It's inspiring. And it's good to know that if, say, your Cessna crashes in the middle of nowhere, your body could actually function for a good chunk of time on stagnant water and snake meat. I could watch a whole episode just for the before-and-after photos. What a great way to lose weight.

THE ULTIMATE SURVIVAL DOG:

The German shorthaired pointer



DURING THE GOOD TIMES, the pre-apocalypse, you want a dog that's loyal, smart and obedient. You also want a dog that barks like hell when a stranger walks up your driveway. The German shorthaired pointer has these qualities and a lot more. The breed has pulled sleds, carried packs, and gone into battle with elite forces. Its webbed paws make it a good swimmer. It can be trained to retrieve game that you kill – or to kill small animals itself. The dog's versatility derives from deliberate breeding: Spanish and English pointers, the dalmatian, the vizsla, and a tracking hound all went into making this crafty canine. Its complex ancestry also makes it susceptible to few ailments and likely to live up to 14 years. So maybe stock up on dog food, too. – JOE BARGMANN

PREPPER JARGON DECODER

→ to just say it. → **HARDENED ELECTRONICS:** Impervious to the effects of particle radiation or electromagnetic radiation. →

THE SITUATIONAL GUIDE TO SUPERFLUOUS SURVIVAL

BY MATT GOULET

YOUR HANDS ARE IN DANGER OF GETTING FROSTBITE

K-Way Men's Broad Peak Alpine Gloves (R799) are windproof, water-resistant and breathable to ensure your hands remain comfortable and dry. Inner fleece gloves provide additional insulation, and the outer shell features leather palm patches for extra grip and protection.



YOU NEED TO KEEP WARM DURING A NUCLEAR WINTER

K-Way's Men's Romulus 3-in-1 jacket (R2 299), although primarily designed for snow sports, can be worn three different ways to suit different conditions. The robust outer waterproof shell can handle water columns of up to 5 000 mm and features an adjustable and removable hood.

GEAR

Stuff you
may not
absolutely need,
but, boy, it'd be
nice to have.

YOU'VE BEEN
FORAGING ALL DAY
AND REALLY NEED A
PICK-ME-UP

GSI's Commuter Java Press (R375) and Coffee Mill (R499) ensure you get that decent caffeine fix, just like you would at home. Made out of co-polyester, both items are extremely durable, making them ideal for the rigours of the bush.



MAKE A PLAN, STAN

The ability to fix gear on the fly is imperative if you want to survive the great outdoors. Leatherman's MUT multitool (R2 999) not only has all the blades you need to get things done, but is kitted out to help service firearms, too.



THE DEFINITIVE GO BAG

Labelled in order of priority, for your convenience.

FIRST PRIORITY

Eton FR150 MicroLink AM/FM emergency radio with built-in cellphone charger, hand crank, and solar panel. Essential.

Knife.

Maglite LED flashlight. Doubles as a weapon.

Extra batteries.

Whistle. (See "How To: Signal for Help," page 58.)

Mirror.

Flint and tinder.

Multitool.

Mylar blanket. Lightweight and warm.

Extra pair of weather-appropriate clothes.

Tarpaulin, tube tent, or dropcloth.

Paracord (30 metres). Durable and versatile.

Any necessary medication.

First-aid kit.

Non-perishable food, such as MREs or canned goods. (See "The Dehydrated-Food Taste Test," page 57.)

Water bottle with filter, LifeStraw, or canteen.

Canteen cup.

Gloves. Thick enough but not too thick.

Rain poncho.

Local maps, preferably topographical.

Waterproof matches/butane lighter.

Potassium iodide/chlorine tablets. A few drops decontaminates your water.

SECOND PRIORITY

Collapsible spade. For fire pits and latrines.

Metal spork.

Insect repellent.

Toilet paper. (See "How To: Loot," page 59.)

Soap.

Sunscreen.

Refuse bags. Good for food storage or a makeshift poncho.

Sunglasses.

Watch. Glow-in-the-dark, if possible.

THIRD PRIORITY

Waterproof document packet: ID, passport, birth/marriage certificates, deed/lease, car title, insurance information.

Cash. Small denominations.

Twelve-hour candle.

Wet wipes. For hot wings.

Hand-cranked can opener.

Hand sanitiser. Bonus: highly flammable.

GEAR

CONTINUED

YOU NEED TO TAKE SHELTER FAST

Building a shelter can be a chore, especially in warm dry weather. Ticket To The Moon's Single Hammock (R325) can be set up in a matter of seconds and packs down smaller and much lighter than a tent.



YOU'VE LOST CONTACT WITH YOUR LOVED ONES

Zartek's Pro 8 Twin Radio Pack (R799) will keep you connected, regardless of what terrain you're negotiating. Transmission ranges vary between 2 and 5 km (flat terrain) and 5 and 20 km (elevated line-of-sight). The radios each weigh a mere 67 g and feature outer casings manufactured out of high-impact materials.



GO CATCH SOME GRUB

Bagging some fresh protein on the fly is a cinch with Velocity Archery's Firecat slingshot (R250). Apart from having an almost unbelievable 200-metre range, it also features a unique pushbutton ammo release function.



YOU'VE GOT TO FLEE, BUT WANT TO TAKE EVERYTHING YOU OWN WITH YOU

K-Way's extra-large Evo Gearbag (R550) is seriously tough, thanks to its polyester HD ripstop and PU coated construction. Closed, it's the size of a book bag. Open, it has a whopping 140 litres of storage.



THE GOURMET SURVIVAL KITCHEN

There's no point in stocking delicious food if you can't cook it.

BY WYLIE DUFRESNE

I've spent a lot of time thinking about and preparing for disasters. To tell the truth, I started out on the fringe, buying enough ready-to-eat meals to put me on a government watch list. But then about a year ago, I realised my plan was absurd: my kids won't want dehydrated veggie burgers. During the apocalypse, your duty is to keep up morale –

and nothing is better for that than a great meal. To make one, you still need to be able to cook. Here, a few essentials.

FIRE

Matches don't take up much space. Keep them around. And make sure the ones you buy are storm-proof. (You can make your own by dipping standard matches in melted wax.) I also recently discovered the Soto Pocket Torch, which turns certain disposable lighters into a minitorch. It's great for mending a frayed piece of paracord or, better yet, making s'mores in your living room.

A CAMP STOVE

One of my favourite portable stoves is the Jetboil Joule Cooking System. I like Jetboils in general, but this one is serious: it puts out 10 000 British thermal units, and the pot on top holds more than two litres, which is good for when you need to cook for a few people.

You should also have a Power-Pot: the five watts of energy it creates while heating water (up



to 1,4 litres) will charge any device that plugs in to a USB.

A WORST-CASE-SCENARIO STOVE

If you are without matches or any other way to produce a flame, you can still make a hot meal if you have the Barocook system. It generates heat with a chemical reaction. You simply pour water over the heating pack, then put a tray of food on top. So in the middle of the worst, you can just pretend you're at a really weird buffet.

↑
When times are tough, nothing lifts spirits like gooey s'mores. And booze.

THE DEHYDRATED-FOOD TASTE TEST

Dehydrated foods are perfect for emergencies: non-perishable, lightweight, and easy to prep (just add water). But do they taste like actual food? PM staffers sample a few of Back Country Cuisine's range to find out. Geoff Ward from distributors Outward Ventures proffers this advice: "To avoid any crunchy bits add 10 per cent more water and let them stand for a minute longer."

PHOTOGRAPH BY ZACH GROSS (WYLIE DUFRESNE)

BREAKFAST	LUNCH	DINNER	DESSERT
COOKED BREAKFAST Nutritious, but sadly not so appetising. Would work better at the end of the day when you're really hungry.	VEGETARIAN STIR FRY Filling and tasty, if verging on blandness, with a slightly sweet sauce; mix thoroughly to be sure of even flavour and texture.	THAI CHICKEN CURRY Of all the meals, this one came out the firm favourite. Nice chilli bite, too.	BOBOTIE Surprisingly scrumptious. The only thing missing: a dash of fruit chutney.
			ROAST LAMB AND VEGETABLES Very tasty. The separate sachet of mash has great texture, and the dash of mint is a nice touch.
			APRICOT CRUMBLE Don't be fooled by how different it looks. It tastes just like the real thing.

PREPPER JARGON DECODER

→ **MAD:** Mutually assured destruction, e.g. nuclear war. → **WROL:** Without rule of law. → **YOYO:** You're on your own. → **OMG:** Oh my god.



Consider the ham radio

For emergencies or just idle chatter.

BY JASON FEIFER

This is KD4DYV," I said, announcing my ham-radio call sign for the first time in 20 years. "Can anyone hear me?"

Static.

I fiddled with my handheld radio, an old Icom IC-W2A, and tried again. Nothing. The radio was all that remained of a childhood hobby, back when I also had a big, boxy rig hooked up to a 10-metre antenna in my parents' backyard, and a Morse-code key for tapping out mes-

sages. The technical name for all this is amateur radio, an old-timey pursuit in which operators pass a test, acquire a licence and call sign from the communications authorities, and then spend their days chitchatting across the globe. The term ham was once an insult, a name professionals gave to amateurs with clumsy Morse skills and mediocre equipment.

When I joined as a squeaky-voiced 12-year-old in the 1990s, it was like discovering the Internet before the Internet. Ham is built upon the thrill of the contact: operators routinely hold contests to reach, say, someone in the countries of a particular continent, or they clamour to talk with a fuzzy voice floating in from some far-off island. To confirm conversations, they send each other a personalised postcard. I had hundreds on my wall.

But then I grew up. Now I'm 34, married, and with a kid on the way, and last autumn my dad found my expired ham licence. At first I filed it away as a memento. But then I remembered: when a disaster strikes, ham radios are pivotal to survival.

Operators become community lifelines, with hams talking to each other and working with first responders to relay local conditions. There are even

amateur groups such as Hamnet, a volunteer-based group. I still owned my old handheld, and it seemed foolish not to have it at the ready. So I renewed my licence for free and set about seeing how ham has fared in the digital age.

The answer: quite well. There are now almost 725 000 licensed hams in the US alone, an increase of almost 200 000 since I bailed two decades ago. In part this is because of new technology that enables talk on previously inaccessible frequencies. And to encourage newcomers, it's no longer a requirement that hams know Morse code. There's also a new smartphone app called EchoLink that patches hams into transmission repeaters, devices that receive weak signals and retransmit them with more juice.

With my radio busted, I downloaded EchoLink and found a repeater near my Brooklyn neighbourhood. "This is KD4DYV," I said again. "Can anyone hear me?" This time a voice rose from the static: it was Zane, a dad who lives down the street, and who earned his licence two months ago. Zane recommended buying a R300 Baofeng UV-5R. "I'm on this repeater pretty often," he said, inviting me to return. I will, with my new radio. It's good to know I can reach a friendly voice. Hopefully just to chat, but also just in case.



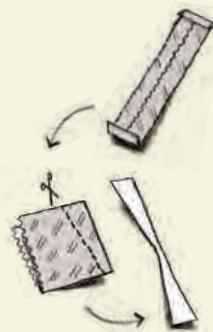
SIGNAL FOR HELP

"If you have a whistle, use a one-two-three, pause, one-two-three pattern. This is more recognisable to the human ear. Mirrors are also important. Nothing in Nature can be mistaken for a signal mirror. Same goes for brightly coloured construction tape." —

THOMAS COYNE, FOUNDER AND CHIEF INSTRUCTOR, SURVIVAL TRAINING SCHOOL OF CALIFORNIA

HOW TO:

MAKE FIRE WITH A TINFOIL WRAPPER AND AA BATTERY



1 Fold an open wrapper in half, width-wise.

2 Fully cut diagonally from the open side to almost the edge on the folded side. Unfolded, the two ends should be wide triangles and the connecting portion as narrow as possible.



3 Hold the foil side of each end on opposite terminals of the battery. The middle section will burst into flames. Have tinder ready.



HOW TO:

ORIENT A MAP

Align north on your compass with the map's vertical grid lines. Rotate the map and compass together until the needle reaches north.

HOW TO: TURN YOUR CAR INTO A GENERATOR

Car electricity runs on direct current, but almost everything else is alternating current. What you need: an inverter. Some cars have them built in, but you can buy one for a few hundred rand. Use the clamps to attach the inverter directly to the terminals on your car battery. Let the car run at idle and you have 220-volt AC power for as long as you have fuel. With a 300-watt inverter, you'll have enough amps to run a laptop or even a television.

PREPPER JARGON DECODER

→ No relation to YOLO. → EDC: Everyday carry. Can be a phone or lighter or a knife or multitool. → BALLISTIC



HOW TO:

BARRICADE YOUR HOUSE FROM THE INSIDE

When bands of marauders start roaming the streets, how are you going to keep them out? Tear down a few walls, says Timothy Ferraro, a 25-year construction veteran who's thought about this situation a lot while watching *The Walking Dead*. "Assuming the attackers don't have a battering ram, you should be able to keep them out using the timber and drywall already in your home," he says.



1 CUT YOUR WINDOW COVERS

Pick a bedroom, cupboard or hallway partition wall. Use a utility knife or handsaw to cut out window-size slabs of drywall. It's stronger than you think, especially if you double or triple it up.

2 YANK THE BEAMS

Got any drywall in your house? Inside every one is a stockpile of timber you can use to fortify your entry points. Using a hammer, bat or spade, knock the studs loose from the bottom plate and then yank them free from the top.

3 LOCK DOWN THE ENTRY POINTS

Nail your beams together in lengthwise pairs at a 90-degree angle to form braces. This makes them stronger. Then run three or four braces horizontally across every door, hammering the nails from above and below directly into the frame at a 45-degree angle. If you drive them straight in, they're easier to pop out when somebody kicks the door. Use more braces to secure the drywall over the windows. Try to use longer nails and leave a few centimetres of each nailhead sticking out for easy removal.

— CLINT CARTER

HOW TO:

SWIM A LONG DISTANCE IN FREEZING WATER

→ Kimberley Chambers, open-water swimmer and the sixth person to ever complete The Ocean's Seven marathon challenge

BREATHE

You must control your breathing and relax – even when the freezing water makes it feel like there's a foot on your chest. Panicking wastes energy.

KEEP MOVING

Even if you think you are not making any progress. As soon as you stop, you lose precious body heat.

FLEX YOUR HANDS

An early sign of hypothermia: claw hands. You can last a long time after this, so flex your fingers closed after each stroke to get blood flowing again.

HOW TO: LOOT

Don't bother with the 50-inch flat screen.

If the world ends, everyone else will be grappling over water, fuel, candles and canned food, all of which you've wisely stored in advance. So take this opportunity to stock up on useful stuff they won't think to take: lip balm and lotion for your soon-to-be-wrecked lips and hands, Vaseline and cotton balls to use as fire fuel and kindling, vitamins, and all the antibiotics you can carry. Kevin Reeve, CEO of OnPoint Tactical survival school, recommends grabbing the penicillin, Flagyl, Cipro, Zithromax, and Augmentin, as well as painkillers such as Percocet and Vicodin. Get tampons if you intend to bring any women with you, and cigarettes, alcohol and lighters that you can trade for whatever you forgot. "And take everything they have in the way of toilet paper," Reeve says. "We call it mountain money."

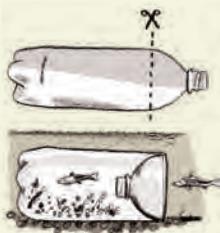
WAMPUM: A stockpile of ammunition that can be used for trade or as currency. → **GOBLIN:** Someone who will start looting or committing other crimes in a survival



A FEW SURVIVAL TIPS FROM THE

SPECIAL FORCES

HOW TO CATCH MINNOWS WHEN YOU'RE STARVING



1 Take a 2-litre bottle, remove the cap, and cut off the top quarter.

2 Turn the top upside down and place it in the bottom three-quarters of the bottle.

3 If you have string, make a small hole at

→ Byron Kerns, former US Air Force Survival, Evasion, Resistance, and Escape (SERE) instructor, and wilderness director and chief instructor at Byron Kerns Survival.

the top of both sides and tie an end of the string to each. This is your handle. If you don't have string, use rocks as an anchor.

4 Place insects or other bait in the bottle bottom to attract fish.

YOUR EMERGENCY SHELTER, TWO WAYS



1 Crawl under the biggest evergreen you can find. Get right up to the trunk.

2 Break or cut off enough boughs that you have room to move around or at least sit up without being poked.

3 Use the branches you cut off, and any other fallen branches or clusters of pine needles nearby, to line the ground for bedding and insulation.

4 If there is snow, use a spade or your hands to dig it out. Pack down the sides of the hole for walls.

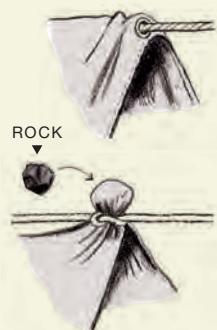


1 The materials: a tarpaulin or dropcloth at least 2,5 by 3 m and a minimum 8 m of cord (preferably parachute cord).

2 Locate two trees roughly 2,5 metres apart. Tie your line around one of them. If it's warm, the cord should be higher off the ground to let in more air and vice versa.

3 Secure the tarpaulin to the cord. If your tarpaulin has grommets (holes with metal rings), pull the line through them on both sides. If it does not, use a buttoning technique (bottom right) before tying the cord to the other tree.

4 Stake your tarpaulin into the ground. If you don't have stakes, use heavy logs to weight the corners.



THE POST APOCALYPSE BIKE:

SPOT BRAND CREAM 55

When society collapses, a bicycle becomes the optimal mode of transport. The Cream (around R90 000), a mountain bike made by Spot Brand in Golden, Colorado, can handle smooth tar and rugged wilderness trails alike. It's also low-maintenance. The frame is sturdy titanium, and it's a single-speed, so no gearing to fuss over. The drivebelt needs no lube and is nearly silent – good for keeping a low profile.

BUGS, NOT BERRIES

Eat insects instead of berries or plants. The wrong plant could debilitate or kill you. Insects just taste bad, and they're an abundant source of protein. But remember: six legs or less to avoid potential poisoning, and roast them if possible to cook away parasites.

LAST-RESORT FOOD, IN ORDER OF DESPERATION



SNACKY

orange and watermelon rinds
Fibre-rich, pairs well with chocolate.



HUNGRY

Tree bark
Remove the tender inner layer, called cambium, and boil strips of it as you would pasta, or grind to powder for thickening soup.



FAMISHED

Leather
Avoid dyes or treatments, if possible, and boil in water to soften.
Can also be roasted into chips.



DYING

Soil/clay
Dig deep to avoid pesticides. If able, bake to kill bacteria, then boil for half an hour and strain. Soil is nutrient rich, and clay is filling.





EXPERT

NICK MEYERS

Director, Mount Shasta Avalanche Centre, Mount Shasta, California

A 14-year veteran of the US Forest Service, Meyers has been the lead climbing ranger of the Mount Shasta Ranger District since 2010. His team is on call year-round to lead search-and-rescue efforts, averaging 10 to 12 annually. A lot of their work has to do with a type of natural disaster that South Africans are not overly familiar with – the avalanche – but there's much useful experience to be passed on about survival in general.

KEEPING WARM

If you're stuck out in the wild, the first thing you need to do is avoid exposure. Wind saps your body temperature and increases the risk of hypothermia. Keep moving to maintain blood flow and retain body heat. No matter what, never go 100 per cent. Always leave a little gas in your tank, because you never know when you'll need it.

GEAR

We use a list called the 10 essentials. It's not definitive – I bring a few extra pairs of socks and, in the winter, a hat, a small bivvy sack, and a ground pad are also crucial – but these things will buy you time in a survival situation.

- ① **Map and compass.** Make sure you know how to use them (see page 58). A lot of people substitute GPS. GPS can work very well, but it has its limits. In cold weather batteries don't last very long – and if they run out, you're bummin'.
- ③ **First-aid kit.** You want to at least be able to stop bleeding and splint an arm. It doesn't have to be giant, since there's not a lot you can do in the field anyway.
- ④ **Sunglasses and sunscreen.** If you are someplace with a lot of snow, like we are, snow blindness is a real concern. And the snow reflects the sun's rays.
- ⑥ **Extra food.** They may be smashed, old, and beat up, but a couple of protein bars can keep you going for another 12 to 24 hours.
- ⑦ **Fire starter.** There are a lot of options. Try stocking your kit with this: take lint from the tumble dryer, put it into a paper cup, and pour wax on it. Put it beneath some kindling, and light the whole thing.
- ⑧ **Extra clothing.** Avoid cotton. Once it gets wet, it loses its insulation abilities and doesn't dry very fast. Synthetic clothing is better. Always have some sort of wind layer. People underestimate the chilling effect of wind. It can be extremely hazardous and can lower your core temperature pretty easily.
- ⑨ **Multitool.** It tends to have a knife on it, so I steer towards that. And it also has other tools.
- ⑩ **Headlamp/torch.** In every pack. You never know. – *As told to Kevin Dupzyk*

PM

who collect guns rather than supplies. Their plan: to raid the prepared and eliminate the competition. **BUDDY BURNER:** A homemade stove for cooking. ☒



5 things you should know about ROOIBOS

Whether it's minor aches and pains or matters of a rather more – ahem – personal nature, in seeking a cure for what ails us we usually look to some exotic plant when the solution could be a lot closer to home. Here are five reasons rooibos reigns supreme among flora. BY LINDSEY SCHUTTERS

Coming straight out of the Cape Floral Kingdom, the smallest but most diverse Unesco World Heritage Site, *Aspalathus linearis* – we know it better as rooibos – is being marketed as a silver bullet for any medical condition you can think of. By now, you should know that a bladder-bursting six cups per day is the recommended daily intake for maximum cancer-fighting goodness and that there's no caffeine, so it's safe for the little 'uns to drink late at night. But what about the insatiable appetite, water retention and raging erections?

Whereas some health claims are simply bizarre, we can proudly boast that the humble rooibos is the closest mankind will get to a renewable pharmacy. Rooibos has been linked as an effective treatment for acne, allergies, ageing, colic, insomnia, eczema and asthma. But all isn't rosy with the miracle tea. Ongoing concerns about the recommended daily allowance were highlighted after a 42-year-old woman was admitted to Tempere University Hospital in Finland with elevated liver enzymes after consuming a large amount of rooibos tea.

But wait, there's more: a Japanese study noted structural changes in the reproductive system of male rats after prolonged exposure to rooibos tea. Although there wasn't any direct evidence of impaired fertility, we'd stick to the Cansa-approved six cups a day. Dive into the unbiased truth about rooibos over the next couple of pages.





ROOIBOS CAN BEAT CANCER

The first thing you need to know about cancer is that, broadly speaking, it's a result of oxidation. The second thing you need to know is that our bodies naturally secrete the perfect sponge to mop up rogue oxygen atoms (aka free radicals) whenever we're exposed to an environment rich in free radicals. The enzyme is called superoxide dismutase (SOD) and rooibos packs it by the bucketload.

A study at the Juntendo University School of Medicine, Tokyo, Japan, administered rats with dextran sodium

sulphate, which is known to mess with their colons. One group was given rooibos tea and one group water. Somewhat unsurprisingly, the serum SOD levels in the urine of the rooibos group was significantly higher and their colons were far less inflamed. The takeout? Rooibos tea can prevent DNA damage and inflammation.

PM VERDICT: Stick to six cups a day to keep your SOD levels up, but limiting exposure to cell oxidation is a good first line of defence.

Rooibos can help beat a hangover

That statement is a little misleading. Allow us to explain. The most common wine allergen is sulphites, the result of winemakers needing to use sulphur as a preservative. All winemakers, that is, except a handful associated with Red Dawn, a holding company that registered a patent that breaks from the tradition of winemaking. This innovative concept is all hinged on using rooibos wood chips instead of oak staves in wine barrels. Since rooibos is exceptionally high in antioxidants, it also acts as a natural preservative, so there's no need for sulphur. The Audacia estate was first to market with a Merlot and Shiraz, but then the group's affiliates Windermere, KWV and Stellenbrau got in on the act by adding the plant to the cider, Pinotage and beer processes. Stellenbosch University is conducting several trials around the use of rooibos in alcohol, so watch the news on that.

PM VERDICT: Our extensive testing didn't lead to any hangovers, but that's more down to a combination of being responsible adults and the acquired taste of the wine. If the jury is still out on this one, the science does seem to support it. We reckon the real winner here is that SA wine, beer and cider consumers now have authentically South African drinks to live next to our superb MCCs and potstilled brandies.



ROOIBOS AIDS IN RECOVERY

A school of thought gaining in popularity is the one that preaches about the myth of lactic acid. Muscle strain is now said to be the result of physical damage and the resultant inflammation that is the body's natural response. And because rooibos is such a champion at mopping up free radicals and reducing the resultant inflammation, science is trying to prove the correlation between drinking a cup of rooibos tea and easing of post-workout discomfort, instead of heading for the massage tent at the end of a race. The trick is in the high levels of magnesium and zinc, which boost testosterone, which helps muscles recover. Rooibos also helps your body absorb iron, which will enhance oxygen delivery to muscles. The relaxing properties of a warm cup of tea will also help you get better sleep.

PM VERDICT: We're not sure. Massage, ice baths and arnica oil have been widely debunked as the cure for post-exercise soreness, but the diehards do have one powerful argument: they feel so good.



ROOIBOS IS THE FOUNTAIN OF YOUTH

Using the same antioxidant theories, scientists have been increasing the risk of skin cancer in a group of mice and then treating them with rooibos. The group treated with rooibos gels and creams showed massive signs of recovery, leading to the conclusion that it could work on humans as well. Bye-bye wrinkles? It's all down to our old friend superoxide dismutase and its antioxidant qualities. Other desirable characteristics of rooibos are its antibacterial properties, its hypoallergenic characteristic, as well as high levels of zinc and vitamin D. Moving away from the skin, a 2007 clinical trial in adults at risk of heart disease done by the Cape Peninsula University of Technology (CPUT) found that drinking six cups of rooibos a day is good for your ticker and will lower your risk of heart disease.

PM VERDICT: Not so fast. The '90s were all about the wonders of tea tree oil and that turned out to be not so wonderful, mainly because of its toxicity when swallowed. A moisturising sunscreen is still the best possible skin-care product you can invest in, but there can't be any harm in switching to one that contains rooibos.



Rooibos will help maintain your erection

The two biggest enemies of the male erection are low testosterone levels and poor oxygen circulation. It's the sort of thing that can happen naturally with age, but here's the thing: male menopause does exist. It's actually called andropause and is caused by a loss of Leydig cells in the testes. Leydig cells are important because they are the primary source of testosterone. Low testosterone levels lead to loss of muscle strength, decline in physical activity and low sperm counts. A 2012 Korean study fed 18-week-old rats a dandelion and rooibos extract complex over four weeks. The results were higher testosterone levels and higher sperm counts. Thirty men who showed ageing-male symptoms were given a 400 mg dose of the same complex and a clinical survey showed a marked improvement in quality of life. At the time of writing CPUT were investigating rooibos as a possible way to weaken the effects of altitude sickness, which it just so happens is an alternative use for Viagra.

PM VERDICT: The evidence speaks for itself. Picking up a pack of rooibos feels a whole lot more casual than asking for the blue pill at your local pharmacy.



UNIQUELY GOOD

Aspalathin, a glucoside found only in rooibos, helps muscle cells use glucose more effectively and stabilise blood sugar levels. This makes rooibos an important product in the fight against type 2 diabetes. **PM**

ALL THE GOOD STUFF:

The complete list of minerals in rooibos

SODIUM **IRON** copper
fluoride magnesium POTASSIUM
ZINC manganese

HUMAN-TIME, *the dust in the cosmic wind*

Does it fly or does it drag? It's all relative, says William Horne





You sit down at a restaurant, by the window, and you enjoy the view as you wait to be served. It's noon, and the restaurant is buzzing. Your wait will be longer than usual, you realise within the first 12 seconds.

Part of human life on Earth is to divide, categorise, and delineate what one encounters. Time is no exception. However, the process is done so consistently and ubiquitously that time has taken on a false objectivity in the minds of Man. The arbitrary division of a day into 24 hours, for instance, has its roots in a human predilection for the number 12 that extends from Ancient India, Greece and Egypt, further fuelled by the contingency of there being 12 lunar cycles in a year.

Before it became pervasive throughout human society, many other systems of perceiving time held primacy. David Landes, in his book *Revolution in Time*, explains that, before artificial light, daylight hours were central to human agency, and thus formed the cornerstone of division of workable hours and life in general. This would mean a more fluid and random division of time as daylight hours changed through seasons, quite unlike the concrete system of the contemporary 24-hour day.

Despite human misconceptions of the centrality of an imposed system of elapsing time, the universe works on yet another time scale, one which is in many ways inaccessible to the human mind. The phenomena of truly large numbers extend beyond the reach of our otherwise vast imagination. According to a 2011 study published in the journal *Cognitive Science*, led by David Landy, most people can conceptualise numbers now that extend far from a million, due to growing familiarity. However, once the boundary of several billion, say, is breached, most attribute numbers above this threshold to the same category of the inconceivably massive, simply because it becomes impossible to visualise.

Humans simply do not function in a way that has to do with too large numbers. Our years on Earth are few, our friends and family number in, at most, the triple digits, and our bank accounts are generally not so large either. So when it comes to possibly understanding the arbitrariness of our imposed and anthropocentric perception of time, it is nearly impossible. When the sheer magnitude of the numbers we must face stand in such stark contrast to our very imaginary boundaries, analogies become the last resort.

At the restaurant, you have now been sitting for about five minutes without being served. Five minutes, any stockbroker will tell you, is a lifetime, and you would be inclined to agree in this instance. But tell a child he has five minutes to finish his game, and you will see a completely different, and still real, view on that very same arbitrary interval.

In terms of our universe though, no amount of time we spend on

Earth is anything but a blink of an eye. While sitting at your table in the restaurant, where your impatience is beginning to surface, if your arrival had been the beginning of the universe, and your eventual departure, the present day, things would seem quite different.

Your stay will average 70 minutes amid the lunch hour rush, from when you arrived at noon. By the time your food has arrived at 12:45, the Earth is only just about to be formed. Before that, though, the universe had gone from four trillion degrees Celsius, cooled, formed protons, neutrons, the first hydrogen and helium atoms, and, eventually, nuclear fusion to form the first stars – all within just those initial 12 seconds it took you to become disheartened by the growing queue for food.

By the time you had been waiting to be served for five minutes, our Milky Way galaxy and its local group had begun to form. In the 40 minutes between that moment and you receiving your food, about 8 billion years had passed in the universe and the materials our planet and solar system would be shaped by, were forged. Along with all the other elements, besides helium and hydrogen that make up our planet, these materials would be forged within the cores of stars where nuclear fusion would alchemise them into what would, eventually, shape our world, and even us.

The last 25 minutes of your stay comprises the history of Earth. One mankind very much enjoys seeing as its own. But the emergence of *Homo sapiens* and its entire development until this very moment, would fly by your window, and the hundred metres of road visible from it, at 12 000 km/h, and be gone within 0,03 seconds.

You call for the bill, but now you don't mind the wait. By the time your voice reaches the waitron across the room, it will be the year 72 014 anyway.

PM

* William Horne recently spent a month at POPULAR MECHANICS in fulfilment of the course requirements for the BPhil honours degree from Stellenbosch University. **References:** David S Landes. 1983. *Revolution in Time*, Harvard University Press. David Landy, Noah Silbert and Aleah Goldin. 2011. Estimating Large Numbers. *Cognitive Science*, (37):775-799.

WHEELS



Compiled by
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WHAT IN THE NAME OF HENRY FORD IS THAT?

IT'S THE POLARIS SLINGSHOT, AND IT'S STREET-LEGAL.

The first time you see the Polaris Slingshot coming at you, it looks like a set piece from some big-budget Marvel movie – this is a mode of transportation for someone with a secret identity and superpowers. There's that wide arachnid front end skimming the pavement with spats and spoilers and open-wheel fenders, a prototype racer from the future. Then the rest of the machine comes into view, and it gets even wilder.

The back end tapers to a point, where a hefty swing arm carries a carbon-fibre-reinforced belt that drives a single tyre. From the front seats forward, it's like a car: bucket seats, steering wheel, GM Ecotec four-cylinder hooked to a five-speed manual transmission. From the rear it's a giant mutant motorcycle. And that distinction makes all the difference: the Slingshot's odd wheel count

both defines its identity and allows it to exist in the first place.

Because the Slingshot has three wheels, the US government classifies it as a motor-cycle. That means, depending on the state, you might need a motorcycle licence and a helmet to drive it. Of course, it's not really a motorcycle, but it's certainly not a car either. At any rate, the motorcycle designation gave Polaris, maker of snowmobiles and off-roaders called side by sides, the freedom to design a machine with no doors, no roof, and no windscreens (it's an option). There's no climate control, no airbags. This is a minimalist trans-

portation experience: 783 kilograms and the wind in your face. The Slingshot makes a Lotus Elise look flabby and decadent.

Whether or not you think the Slingshot is quick depends on your frame of reference. By car standards, it's got a great power-to-weight ratio, with the 2.4-litre four-cylinder putting out 130 kilowatts. Zero to 100 is probably around five seconds, and with traction control disabled the Slingshot will light up its rear tyre. That said, Ducati riders accustomed to 10-second quarter-miles won't find that sort of thrill.

The handling, as you'd expect, is

Three wheels, no roof, and 173 horsepower – an insurer's dream. But it's pretty safe, actually.



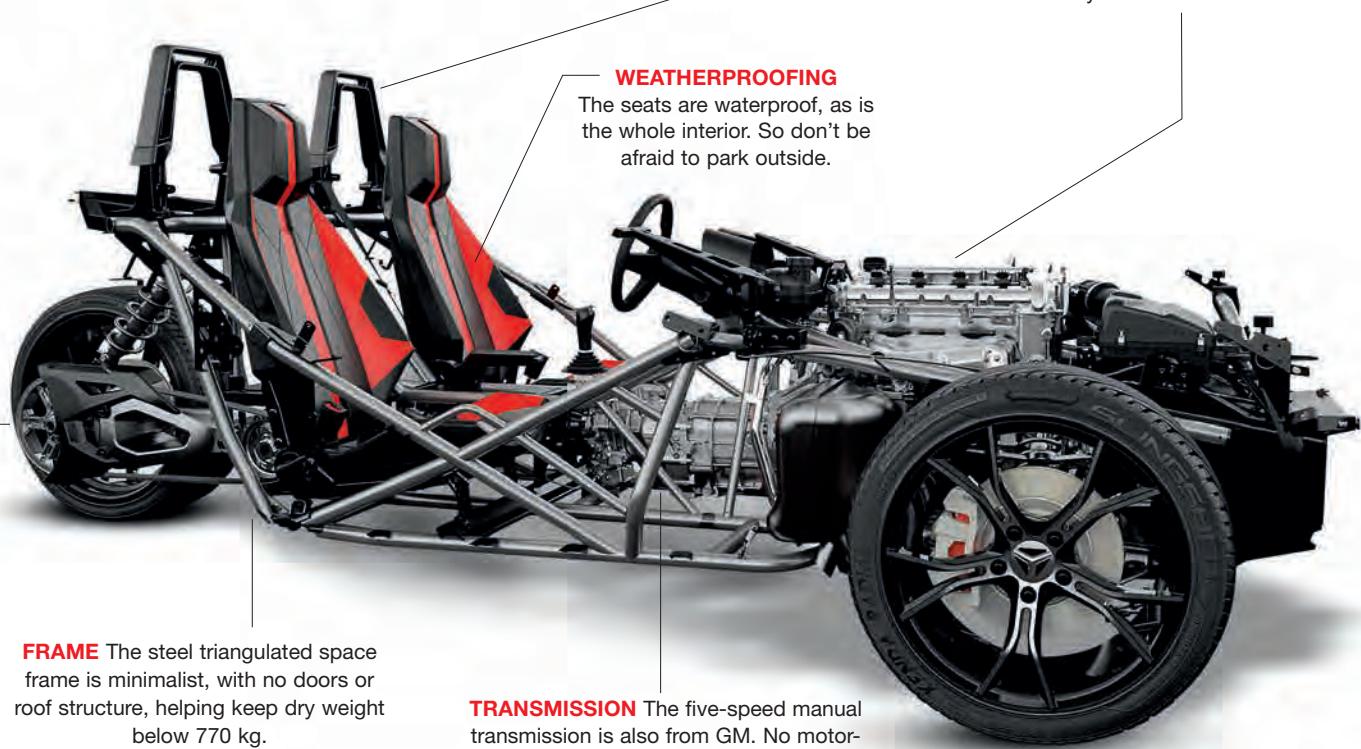
PHOTOGRAPH BY GRANT CORNETT

SLINGSHOT ANATOMY

DRIVEBELT The drivebelt is reinforced with carbon fibre to help withstand the Ecotec's 225 N.m of torque.

ROLL HOOPS Forged aluminium roll hoops above each headrest help on the safety front, but a helmet is still a good idea.

ENGINE The General Motors Ecotec 2,4-litre four-cylinder makes 129 kW and previously served in the Saturn Sky and Pontiac Solstice.



FRAME The steel triangulated space frame is minimalist, with no doors or roof structure, helping keep dry weight below 770 kg.

TRANSMISSION The five-speed manual transmission is also from GM. No motorcycle-style sequential gearbox here.

somewhat different from a car's. Without the stabilising effect of dual rear wheels, turn-in is instant, but a given corner could require a few steering corrections. Still, the body stays flat, and the ride is remarkably supple.

Potholes, though, are a peril. When you straddle a crater between the front wheels, you can feel a mule kick from the back a moment later as the centrally mounted tyre drops in. Such is the price of three-wheel locomotion.

The actual price, however, is surpris-

TWO THINGS THAT HAPPENED WHILE I HAD THE SLINGSHOT

• A woman driving in front of me stopped her minivan, got out, walked over, and said, "Okay, what is this?"

• As I was putting a Captain America helmet on my kid, a guy who looked like Jack Palance said, "I like your style."

ingly reasonable: in the US, around R220 000 to start. That seems like a bargain for a machine that delivers so much visual impact and sheer visceral entertainment. Whatever the Slingshot is, there's nothing else like it. – Ezra Dyer



THE PETITION: Enough with the stop/start engines

It's a great idea, in theory. Your engine shuts off at red lights, stop signs, and busy McDonalds drive-throughs – whenever a momentary pause provides an opportunity to save some fuel. In practice, stop/start systems are annoying, pointless, and sometimes dangerous. Your car is barely using any fuel at idle anyway, and when it fires back up it's with a burp and a shudder, like someone startled grandpa during his nap. And that's if you're lucky enough that it actually restarts. We've had three cars from three different companies execute the stop part of the equation and then fail to restart. So on the plus side, you save a thimble of fuel. Downside: enraged truckers slash your tyres as your lane sits through two traffic-light cycles behind your wondrous miracle of efficiency. Fortunately, every car with stop/start comes with another feature: a button to turn it off.

HYUNDAI i20

STAYING POWER

You know the adage about **beating a king** to become a king? Well, that's kind of what Hyundai are trying to do with the i20, with the proverbial king being Toyota. Korean car makers have been on a good wicket in terms of market penetration, but it seems like Hyundai want to wipe the floor with its Japanese counterparts. The already good previous i20 was second only to Volkswagen's traditionally market-leading Polo in vehicle sales in 2014 and this new model is a significant jump up in quality and specification. Hyundai's volume seller gets wider by 200 mm and longer by 45 mm, gains a rally-inspired torsion beam rear suspension and electric power steering. In the engine bay is a choice of 1,2 or 1,4 litre petrol, with a diesel coming as soon as Korea greenlights the VGI engine for our market (Hyundai South Africa believes the old CRDI engine isn't up to the current emissions and economy standards). There's still space for four



adults and enough luggage for a weekend away and all the electronic wizardry you'll have come to expect as the Korean value offering comes standard.

– Lindsey Schutters

Price: from R184 900

CITROËN C1 AIRSCAPE

IN THE EURO ZONE

SPECS:

ENGINE: 1,2 litres, three-cylinder

OUTPUT: 61 kW and 116 N.m

ECONOMY: 4,3 litres/100 km

BOOT SIZE: 190 litres

PRICE: R194 900

There's something deeply emasculating about driving a small French convertible, more so when it's of the "peel back" rather than the "drop top" variety of roof openings. But when you're done navel-gazing you can appreciate the fun mix of small wheels (14" or 15"), short wheelbase and punchy engine. The new C1 and its revised 1,2 litre engine offer all the kick-up-the-bum thrills of a big sports car at a fraction of the fuel spend and number of speeding tickets.



The interior is quite Spartan, but the few bells are a standard issue reverse camera and 7" touchscreen infotainment system with USB and Bluetooth. C1 Airscape is the cheapest convertible in the land and a step forward for Citroën when the first generation struggled hard to stand out on the Toyota Aygo platform it shares with its Peugeot 107 compatriot.

– Lindsey Schutters

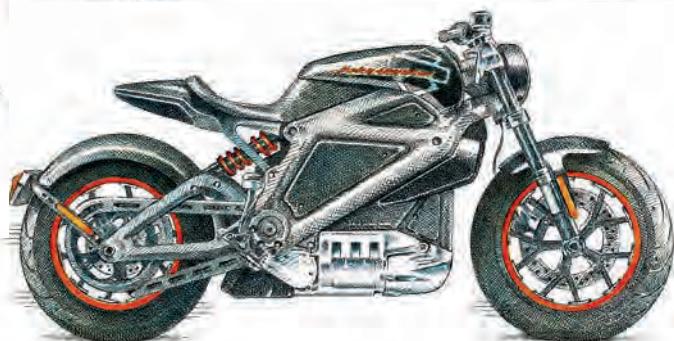


THE MOTORCYCLE, Three ways. All of them fast.

The Rule Breaker 2015 KAWASAKI NINJA H2R

PREVIEW There's a gentlemen's agreement among motorcycle manufacturers: in the name of sanity, nobody strays above 150 kilowatts or a 300-kilometre-per-hour top speed. At least that was the case until Kawasaki decided to ignore rules, moderation, and possibly a few laws of physics. The result is the Ninja H2R, a track-only bullet bike that takes two-wheeled performance to a scary new place. The key ingredient is the motor, a supercharged 1,4-litre four-cylinder that revs to 14 000 revolutions per minute and generates 224 kilowatts. The supercharger is a new planetary gear design created with help from Kawasaki's gas-turbine division, because existing suppliers didn't have a blower that could handle an internal speed of 130 000 revolutions per minute. The bike's carbon-fibre bodywork uses front spars that look borrowed from a Formula One car, providing downforce that riders will appreciate when nearing the H2R's top speed – over what old-timers know as 200 miles per hour, which in metric parlance is 320 km/h. The H2R isn't street legal, but Kawasaki knows it can't prevent customers from adding, say, lights and Department of Transport-compliant tyres. This is one case where a licence plate might be the wildest modification of all.

ILLUSTRATIONS BY JOHN BURGOYNE



The Deceiver 2015 INDIAN SCOUT

TESTED The Scout looks like a laid-back cruiser, but its classic styling conceals modern, high-performance technology, courtesy of a new fuel-injected, liquid-cooled V-twin that kicks out a 75 kilowatts and 98 N.m. Dual overhead cams and four valves per cylinder give the Scout big lungs at high revolutions per minute, while good old-fashioned displacement – 1 133 cubic centimetres of it – provides plenty of torque. With an aluminium frame helping keep weight down to 253 kilograms, the Scout has a better power-to-weight ratio than a Porsche 911 Turbo. So whereas it's happy to putter around town looking good, it can still boogie when it wants to.

The Screamer HARLEY-DAVIDSON PROJECT LIVEWIRE

TESTED Is a Harley still a Harley without the rumble? That's the question behind Project LiveWire, an all-electric concept Harley built more than 20 examples of to gauge public interest. So far, feedback is pointing towards the green light for production. With instant torque and no shifting, the bike screams off the line. Harley estimates a zero-to-60 time of four seconds and a range of 85 kilometres. Weighing just 210, LiveWire is agile and extremely quick around town. And while there's no rumble, intentionally noisy straight-cut gears mean that accelerating towards the 150 km/h top speed produces the keening cry of a spacecraft going into warp drive. – ED

THIS MONTH IN LIFESAVING TECHNOLOGY

Everyone dumps his bike. It's basically a rite of passage. And let's not forget about the dangers that come from distracted drivers. So having the best safety gear is crucial. That's why we like Spidi's new Neck DPS Airbag Tex Vest. Light, and loose enough to fit over your own riding gear, the vest uses a CO₂ cartridge connected to a tether attached to your bike. If you fall off the bike, the tether snaps free from the cartridge, inflating two sturdy airbags around your neck. You won't want to leave your bike without it.



OPEL CORSA

RUN THIS TOWN

My driving partner on the launch of SA's fourth-generation (but actually fifth-generation) Corsa is Italian. This is important because Opel, a German manufacturer, has stuck with an Italian name for its compact car since debut 1982. When I owned one years ago, it meant freedom. Turns out Corsa actually means "run" or "race". The new car comes in two engine choices (1-litre or 1,4 petrol), predominantly manual because the auto box doesn't play well with the Adam-sourced 1-litre Ecoflex engine (hence the addition of a 1,4) and three spec levels (Essentia, Enjoy and Cosmo). Handling is good, performance is adequate and build quality is solid; a good step forward for a beloved brand. Opel has snuck in the frustrating Bringgo system that uses the connected smartphone for GPS, creating massive opportunities for inopportune system failures. Blindspot assist and park assist are optional packages across the board and the Corsa will even park itself if you choose the right package. Opel had an under-appreciated value-for-money hit with the excellent revised Astra and seem to have another in the garage now. – *Lindsey Schutters*



ENJOY



COSMO



ENJOY

PRICING

1,0 ECOFLEX ESSENTIA	R185 500
1,0 ECOFLEX ENJOY	R216 200
1,4 ENJOY (AUTOMATIC)	R216 500
1,0 ECOFLEX COSMO	R236 300 (+R5 000 for advanced park assist)

1,0 ECOFLEX SPECIFICATION

- 85 kW
- 170 N.m
- 117 g/km CO₂
- 5 litres/100 km

COSMO





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A BEAUTIFUL THING

A MAPLE HEART LONGBOARD

COMPANY:

Warren Pieces

OWNERS:

Whitney Phillips and
Matt Groom

LOCATION:

Warren, Vermont





You could call Warren Pieces a carpentry company that happens to make skateboards as easily as you could call it a skateboard company that also takes on big carpentry projects. The same goes for the owners, Whitney Phillips and Matt Groom.

Both grew up in the US northeast, in Vermont, and were participants in the region's action-sports scene, spending the school years at a ski academy and banging nails on construction jobs during the summers to pay for their winter lift tickets. After each served a few years in corporate jobs, they both came home, got back into woodworking, and, in 2011, Groom hired Phillips to restore the intricate shelving of a wine cellar destroyed by Hurricane Irene. They couldn't believe the amount of leftover fine hardwood scraps that were destined for the incinerator after projects, so they started collecting the spare pieces of walnut, oak, maple, and cherry – much of it native – and hauling them back to their workshop. With a lull between jobs, and Whitney's son's birthday coming up, the two set to making the kid a skateboard with the stockpile of scrapped wood. Their two worlds – wood and action sports – fused.

They've been making skateboards, longboards included, ever since. They've discovered along the way that the type of wood they use, its thickness, and the orientation of the grain in the veneers they lay over the bamboo bases impact a ride as much as they do the board's look. For instance, harder woods lend themselves to a stiffer board, whereas you get a smooth, surfboard-like feel with relatively softer walnut. Mistakes made on one board inform improvements to the next; Matt, Whitney or one of their employees tests each deck on beer and food runs from the studio to the centre of town. In this way, they've perfected their own brand of skateboard and, with their mash-up of extreme-sport passion and colonial-style craftsmanship, tapped into something uniquely Vermont. – MATT GOULET



UNIQUELY MADE-IN-SA

Kent Lingeveldt doesn't want to churn out thousands of replicas in his Cape Town workshop. First, he makes his decks out of good old SA pine instead of the more popular Baltic birch plywood. His reasoning is simple: import poor quality birch, or make boards out of the best local wood he can find. Second, Lingeveldt wants a board design to be personal. If you want a longboard from Alpha then you need to meet Kent first to discuss design and artwork. "I work with a lot of local artists, but I focus on stencil work or vinyl printing my photos," says Lingeveldt of the striking artwork on his decks.

Although the pine plywood won't stand up to the punishment of skate parks and stair jumping, the compliant ride is perfect for bombing down steep hills or carving up city streets. Most decks that come out of Alpha are cruisers that get mounted on top of the trucks. The drop-through decks (where the trucks are dropped through holes in the deck) are a lot more stable and faster because of the low centre of gravity. This design, inspired by Formula 1 cars, provides a better-connected feeling. More: <http://alphalongboards.com/>

- You can now get Alpha Longboards in Hamburg, Germany.



SKILLS

A person's hand is shown pouring hot water from a stainless steel kettle into a French press coffee maker. The French press is filled with coffee grounds and is sitting on a black trivet. The background is dark, and the lighting highlights the steam rising from the coffee and the shiny surfaces of the kettle and the French press.

HACK YOUR COFFEE

Forget latte art. Brewing coffee is science.

BY FRANCINE MAROUKIAN

Despite what some baristas want you to believe, making coffee is not an art. It's a mechanical process more akin to culinary science, in which an ingredient is acted upon in ways proved to produce the best-tasting, repeatable results. As master roaster and resident palate at La Colombe Torrefaction, the venerated Philadelphia-based coffee company, Jean Philippe Iberti takes a gastronomic approach. "I treat it like spiced water," he says. "Coffee beans and spices – which are extracted from bark, roots, seeds, buds and hard berries – are grown in similar climates, and both require the application of controlled heat to release their essential oils and unlock their endlessly variable flavours."

Although specifics vary with preparation method, Iberti explains here the principles for the classic French press, a laboratorial glass beaker with a plunger lid set in a stainless-steel casement with Bakelite handles, the style popularised in Parisian cafés during the mid-fifties. As with most culinary endeavours, practice plays an integral part in the success of your final product. "Making coffee is a personal ritual," Iberti says. "There's always a range within each step, a give-and-take in the process as you experiment to find your own taste." Make coffee often enough – say, every morning and twice on Sundays – and your senses will eventually take over: at some point, you'll be able to tell from the aroma and colour when it's done, producing café-quality results at home – minus the waiting in line and all that attitude behind the counter.

HOW TO MAKE COFFEE IN A FRENCH PRESS



Coffee architects: La Colombe Torrefaction's Jean Philippe Iberti (left) and brew crew member Caleb Lewis.



A HOME-MADE COFFEE ROASTER

Until about six months ago, Howard Freilich bought his coffee like the rest of us, preground and puroasted, off the shelf. Then the former industrial electrician, who now runs his own saw-blade sales business out of his home in Richardson, Texas, learnt that your typical canister of coffee is at optimal flavour for only two weeks after roasting. So he set about roasting his own beans. Two prototypes later (the first ones weren't sturdy enough), he combined a heat gun – with its casing stripped off so as not to imbue the beans with a plastic flavour – and a rotating canister on a 12-volt gearbox. In about a quarter of an hour his rig puts an even, dark roast on 325 grams of fresh coffee beans that he buys from a nearby roasting plant. Enough to last him, yep, two weeks at a time. The man has devised a way to create some of the smallest batch coffee right on his kitchen counter.

RUN ONE BREW CYCLE WITH JUST WATER – no coffee – to saturate the filter. This will remove the filter's papery taste, as well as eliminate surface irregularities and dry spots, allowing the brewing water to soak the grounds more evenly. Now run a second brew cycle with the coffee.

THE TEMPERATURE



Bring the water to a boil, 100 degrees, then remove it from the heat and let it sit for 30 seconds so that it falls into the 93° to 98° range.

Any higher and the heat will draw unwanted elements out of the grounds, giving your coffee a slightly bitter flavour and a silty quality that coats the tongue. You can insert any digital-probe thermometer to check for this, but if you want perfect accuracy, try the Bonavita Variable Temperature Digital Electric Gooseneck Kettle. Its temperature increments – every degree between 60 and 100 C – allow for near-pathological levels of control.

THE WATER



“Although I have respect for the coffee/water ratio, when it comes to making coffee in the morning I am more caveman than scientist. I eyeball it, adding ground coffee to the beaker so it looks like one part coffee to six parts water volumetrically,” Iberti says. Dissolved solids from coffee make up only 1,2 to 1,4 per cent of the final beverage, so what kind of water you use is important as well. Iberti’s choice: bottled spring.

THE GRIND



Fine grounds have more surface area and will release flavour more quickly than coarse grounds, so if you want uniform extraction, you need uniform particle size. (Imagine cutting a raw steak into uneven pieces and then cooking them all for the same length of time – no

good.) To achieve uniformity, use a conical burr grinder instead of a blade grinder. The chop-chop-chop of a blade grinder is like hitting the beans with a machete, and the heat from the motor can activate the coffee’s essential oils, producing wildly uneven results. A conical burr grinder, on the other hand, pulverises the beans between two abrasive surfaces, allowing for more consistency. The Hario Skerton grinder does this simply, with a hand crank. Aficionados might try the motorised Baratza Virtuoso, which has a burr mounting system that can produce uniform particles in 40 sizes.

THE POUR



A French press is the only coffeemaker in which you can actually see the water acting as a solvent on the coffee.

On first pour, cover the grounds by just couple of centimetres of water. This is called the bloom – when gases rise, the top foams, and aromas are created. After adding the remaining water, stir once or twice with a long spoon to break the top foam and create a homogenous suspension of the grounds in the water; this is called a slurry. Now put on the lid.

THE TIMING



Lid on, Iberti lets his coffee steep for just one more minute. “Let coffee sit too long and it develops flavours you don’t want, like too much char on a steak,” he says. This is why you should never keep your coffee in a French press after you’ve pressed out the grounds, as it will continue to brew. When it’s ready, decant your coffee into a serving vessel.

ONE MORE THING ...

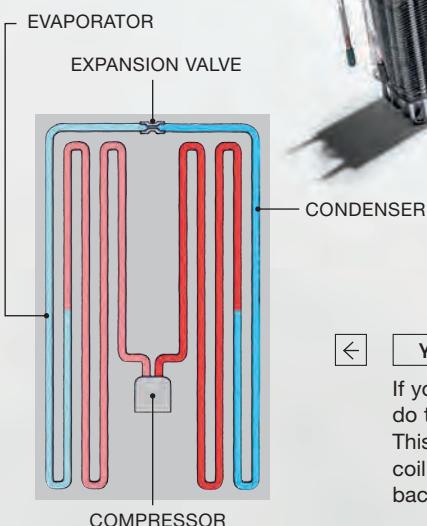
If you like your coffee with milk, fill a clean French press about one-third of the way with warm milk. Slowly insert the plunger and pump it (like a bike-tyre pump) until the milk foams and expands to twice its volume. The milk will be silky, frothy and ready to pour into a café au lait.

ALL THE STUFF THAT MAKES STUFF COLD

A lesson in fridge anatomy

BY ROY BERENDSOHN

A REFRIGERATOR IS AN unnatural thing: a box of cold air made up of components that use electricity (hot) to move heat (also hot). If you sit next to one on a quiet day, you can hear the appliance paradoxically working – the whispery trickle of refrigerant boiling in the evaporator coil. Looking at this literal black box, you might be inclined to tear it to pieces looking for answers. But you won't have to, because repairclinic.com technician Chris Zeisler helped us do it for you. He disassembled a standard Whirlpool side-by-side refrigerator-freezer with door-front water and ice dispenser. He found dozens of parts. None of which, it turns out, is particularly mysterious.



YES, BUT HOW DOES IT WORK?

If you want to make a hot space cold, you need to carry heat energy away from it. To do this, a refrigerator uses a chemical called a refrigerant inside a length of sealed tubing. This refrigerant absorbs heat from the freezer in a portion of the tube called the evaporator coil. It then moves to the compressor and then to the condenser coil at the bottom or back of the refrigerator and releases that heat into the air.



In 25 years, repairclinic.com's Chris Zeisler has never faced an appliance problem he couldn't fix.



1. EVAPORATOR: Turns liquid refrigerant into vapour, allowing it to absorb heat from the air in the freezer compartment.

2. COMPRESSOR: Compresses refrigerant vapour.

3. CONDENSER: Receives compressed refrigerant vapour, condensing it into liquid, releasing its heat to the surrounding air.

4. WATER FILTER: Removes impurities from water for ice or chilled water.

5. WATER-INLET VALVE: Controls water flow to the icemaker and chilled-water dispenser.

6. DEFROST CONTROL BOARD: Regulates the defrost cycle to melt ice that accumulates around the evaporator in the freezer.

7. AIR DAMPER: Shutters on the damper control the airflow from the freezer compartment to the fresh-food compartment.

8. CONDENSER FAN: Blows air over the compressor and the condenser coil, cooling the compressor and increasing the coil's ability to release heat.

9. DISPENSER PUSH-BUTTON SWITCH: Controls on/off function for dispensing ice and chilled water.

10. AUGER-DRIVE MOTOR: Powers the auger that turns ice out of the bucket, forcing it down the dispenser chute.

11. AIR-DAMPER CONTROL AND THERMOSTAT: The two parts work together to control

airflow from the freezer to the fresh-food compartment. The damper control (on the right) and the thermostat (on the left) allow the refrigerator to respond automatically to a temperature that you set manually.

12. EVAPORATOR FAN: Blows air over the evaporator coils, increasing their heat-absorbing capability.

13. ICE-CRUSHER SOLENOID: An electromagnetic coil that controls the ice crusher.

14. RUN CAPACITOR: Energises compressor-motor winding to provide a rotating magnetic field within the motor.

15. WATER LINE: Carries water from the water valve to the icemaker in the freezer.

16. ICE-CRUSHER PLUNGER: Pulled in by the ice-crusher solenoid, the plunger assists in dispensing crushed or cubed ice.

17. DEFROST HEATER ELEMENT: A resistance heater that melts the ice that forms from frozen condensation on the evaporator coil.

18. WATER-LINE CONNECTOR: A fitting that connects water lines within the refrigerator.

19. DISPENSER MICROSWITCH: Energises or de-energises the chilled-water or ice-dispensing circuit.

20. CRUSHING BLADE: Crushes ice.

John Kempf, a Freedom High junior and auto club member, uses a linear motion to sand body filler.



THE KIDS IN THE GARAGE

How to strip, repair, repaint and rewire an old car – with help from an after-school car club.

THANKS TO THE LOWER DRIVING AGE IN THE US, it's not uncommon for high schoolers to spend their spare time working on cars – often their own cars. Their South African equivalents, who have to wait until they're 18 to start driving solo legally, would give their eyeteeth to experience the pleasure of tinkering like Freedom High School's car club in Freedom, Wisconsin. But the lessons those pupils are learning in working on their project cars – a 1974 Oldsmobile Delta 88 and a 1981 Chevrolet Camaro Z28 – apply to *any* car enthusiasts, particularly newbies. Metal repair, for instance.

Both cars had panels with enough rust and metal damage that they needed to be patched or entirely replaced – by welding and using plasma cutters, much to the students' enjoyment. (Naturally, the paintwork has to be reduced to bare metal before this step.) But many of the panels had dents the club could fix just with body filler. "My favourite part is the bodywork," says 16-year-old Cole Woods. "I like seeing the progress of an old car from rusty to shiny-new."

HOW TO FILL A DENT

Tips from the Freedom High School Automotive Programme.

Regardless of a car's age, if a dent is less than about 5 mm deep, it's fine to use body filler. If the dent is deeper, the metal must be straightened first, or you run an increased risk of the filler cracking, chipping, or adhering poorly.



STEP ONE

PREP THE DENT

Before you start, clean the damaged area with a preparation solvent, such as Pro/Base Low VOC Surface Cleaner. Use a swiping motion to keep from spreading contaminants. Then, if applying the filler to a car with paint, use 80-grit sandpaper to sand the surface down to the primer. If working on bare metal, abrade the metal enough to show small scratches. These will help the filler stick.



STEP TWO

FILL THE DENT

Use a paint stick to place the amount of filler you need on a mixing board. Carefully fold in the

hardening cream (it should come with the filler) according to the manufacturer's instructions. Then use a body-filler spreader to smoothly apply the blend until the dent is completely filled. Make wide passes so that the filler also covers some of the metal surrounding the dent. This accounts for shrinkage and makes the coverage more even.



STEP THREE

SAND

Using 80-grit sandpaper, cross-sand the filler until it is level with the rest of the surface metal. Then, using 180 or 320-grit sandpaper, continue to cross-sand the area until the edges are feathered – thoroughly blended into the surrounding metal. The deeper scratches from the coarser sandpaper will help hold your first coat of primer.

→ NEXT MONTH

BODY SANDING AND PRIMING

ILL ADVISED FILLING MATERIALS THE FREEDOM AUTO CLUB HAS FOUND IN OLD CARS:

newspaper • crate foam • glass fibre • aluminium cans • a cardboard beer case • parts of a screen door

WIN! with our home workshop challenge

AND ANNOUNCING: Workshop Challenge No. 2

Accept the PM Home Workshop Challenge and a top-of-the-range cordless drill driver kit, valued at R6 794, could be yours.

CONTEST NO. 2

THE CHALLENGE: devise a joint project for a father and son. Or a mother and daughter. Guardian and ward, for that matter. We want to see something that can transcend the generation gap, perhaps even put that gap to good use. To get an idea of what we're after, see our "Walking stick robot" project on page 96.

PRIZE:



The winner will receive a **Makita DHP458ZK Cordless 18V Lithium-Ion Impact Driver Drill Kit**, valued at **R6 794**. This top-of-the-range Makita 13 mm impact driver drill features a battery indicator that displays the remaining battery charge; twin LED lights that illuminate when the trigger is pressed and 3 functions – drilling, hammer action and screw driving. The DHP458ZK provides plenty of power for those demanding tasks, with 21 torque settings to choose from, giving you perfect control and maximum torque of up to 91 N.m. It is extremely compact, with a two-speed metal gearbox and steel keyless chuck. It features a rubberised grip, an extended side handle for greater control, a reversible belt clip for both left- and right-handed operation and a twin bit holder.

The prize includes: 1 x **Makita DHP458ZK impact driver drill** (supplied in a handy carry case) with 2 x 4,0 Ah **Makita Li-ion batteries** (BL1840), which recharge in 36 minutes, and a **Makita compact fast charger** (DC18RC).

For further information, visit www.makita.co.za, like Makita on Facebook **Makita-PowerToolsSA** or call 011 878 2600.

Your project will appear in a future issue of **POPULAR MECHANICS**.

Email your plans and a picture of the results to **popularmechanics@ramsaymedia.co.za** by 24 April, 2015.

Official rules can be found at popularmacnics.co.za



A project to build with your children.
DESIGNED BY ROY BERENDSOHN

MONSTER MASK



EASY | REASONABLE | HARD

Difficulty:

Time: 30 minutes (or less)

Ages: 6 to 12

Materials

QTY. | DESCRIPTION

1	Pair flexible plastic safety goggles
2	40 mm PVC reducer fittings
1	Brightly coloured bungee cord
1	Cleaning pad
1	String mop

TOOLS Hot-melt glue gun, scissors

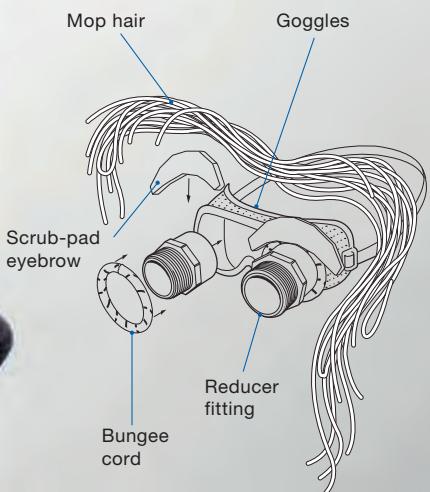
Instructions

• Kid-only

• Parent and kid

STEP-BY-STEP

1. Use a hot-melt glue gun to fasten the reducer fittings to the goggles.
2. Cut bungee cord to length, then wrap and glue the cords around each fitting, glueing the ends to prevent fraying.
3. Use scissors to cut the cleaning pad into two arch-shaped "eyebrows". Fasten them above the fittings with hot-melt glue.
4. Cut off a section of the string mop and glue its supporting band to the goggles' top shield.



TOOL RESTORATION CLINIC



This ball-peen-hammer head looked dead before we removed the rust, polished the bare steel, applied a glossy enamel, and added a life-affirming new handle.

Deep in the drawer, everybody has old, worn tools that could live useful lives again. To rescue one requires patience, sturdy abrasives – and vision. BY ROY BERENDSOHN

A neglected tool has an odd, magnetic power. It pulls you in. Pick it up and, the next thing you know, you're scraping away rust with your thumbnail, trying to make out the manufacturer's name. You vaguely recall how you came by it: a red tag sale, or your father-in-law, or a neighbour who was moving away. "Everybody has them, these little hidden jewels," says contributing editor Richard Romanski, a fine woodworker and unrepentant tool collector. "Restoring them is pretty easy." We gathered a bunch of forlorn implements and went to work in his studio, a cavernous former church in North Salem, New York. We found that all it takes is some basic chemistry and a little work to salvage tools that look like they've been sitting on the bottom of the ocean for a century or two. ▶



1



3



2

THE MACHINE

THE RESTORERS

THE EQUIPMENT

Craftsman table saw, circa 1980s, purchased at a church auction for R800.

Pictured in the photo above, from left: contributing editor Richard Romanski, editor-in-chief Ryan D'Agostino, and senior editor Roy Berendsohn.

Adjustable wrenches for disassembly, air compressor to remove debris, paraffin and a 12 mm drill with wire cup brush for the rust, dead-blow hammer, rulers, machinist's square.

Target: RUSTY, WOBBLY TABLE SAW

Even a good machine can be rendered inoperative by a little rust and parts that go out of alignment.

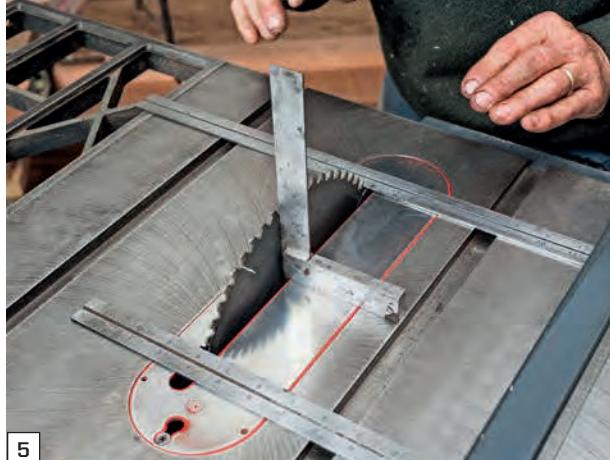
A table saw that earns its keep in an unheated garage, shop or barn will soon rust. Condensation forms on its steel and cast-iron parts because they are cooler than the surrounding air (1). The rust makes it difficult to slide a piece of plywood across the table, which should be smooth and non-abrasive. It also makes it hard to raise and lower the blade or adjust its tilt. This early 1980s Craftsman saw cost R800 at a church auction. Its table

was rusty, and its parts had been thrown out of alignment.

The first step was to move the saw to a warm, dry workshop. We took it off its rolling stand and hoisted it into a pick-up, then drove it down the street to Romanski's studio (2).

Next came disassembly. We unbolted the cast-iron wings from each side of the saw and removed the motor (3). We were pleased to find that the motor was a commercial-duty type with twin capacitors – one to start the motor turning and another to provide extra kick to the run winding. The motor's shaft and pulley were all in good shape. We used compressed air to blow accumulated sawdust and cobwebs out of the saw's cavity (4).

Next came removal of surface rust from the saw's table and



wings. We wet down the surface with paraffin as a cutting lubricant and left it alone to penetrate while we ate lunch. To buff the rust away, we chucked up a variable-speed electric drill with a 65-mm abrasive nylon cup brush embedded with 240-grit aluminum oxide. At a low 500 r/min, with a back-and-forth movement, the brush removed the rust without marring the surface.

We mounted the wings back on the saw and found that we could align them with the saw table by flexing them slightly and carefully tapping them into position with a dead-blow hammer.

After placing a new 250 mm carbide blade on the arbor (the shaft the blade goes on), Romanski used a machinist's square to ensure the blade was perpendicular to the table. With the blade

at 90 degrees, the pointer on the saw's tilt scale should read 0 degrees – if not, the pointer is moved to the zero mark. Next we adjusted the fence and its locking mechanism to make it snug, a fussy trial-and-error process. With the saw blade raised to its full height, we used a pair of steel rulers to check that the fence was parallel to the blade at the front and back (5).

The tune-up was completed when Romanski reinstalled the motor and used a long steel ruler to align its pulley with the pulley on the saw's arbor shaft. We buffed on a coat of paste wax to provide rust protection and bolted the saw to its stand. Once it was in place, we made a few test cuts on some scrap pine to check for alignment. It was perfect (6).

SKILLS

PROJECT

Target:

CORRODED HAND TOOLS

Tools grow dull, and when they grow dull they are set aside, and when they are set aside they rust. And rust begets more rust, until they look like these. Time to dig in.

Rusty tools turn up in the garden shed of the house you just bought. A friend gives you a boxful of them. Often their handles are rotted away and their steel is so rusty that you could get tetanus just by looking at them (1).

To restore a pile of ball-peen-hammer heads and a couple of hatchets, we first removed what was left of their handles. We sawed off the handle stubs using a handsaw, then clamped each head in a machinist's vice and used a punch to knock out the remainder of the handle.

Corrosion removal began in earnest when we submerged the heads in a bucket containing 5 litres of white vinegar, an inexpensive supermarket item. We covered the bucket with a piece of plywood and let the parts soak. After about four hours we took a few out and tried scrubbing off the rust with No 1 steel wool (2), and – wouldn't you know it? – a little came off. There was hope.

We dunked the tools back in the vinegar overnight, then hit them again with steel wool. (Steel wool is available in eight grades of coarseness, ranging from superfine, No. 0000, to extra-coarse, No. 4. We had good results with No. 1 wool, but you may need to go more or less coarse, depending on the amount of corrosion.)

The rust came off. We rinsed the tools thoroughly in clear water to remove any last trace of vinegar and wiped them dry. Severely pitted surfaces were then smoothed out using a 100-grit abrasive on a disc sander, and heinous damage – metal that had been peened over by a hammer blow, for example – was rectified by clamping the head in a machinist's vice and hand-filing the surface smooth. Finally, the tools were wiped clean with mineral spirits, primed with a rust preventive metal primer (we used spray-on Rust-Oleum), and painted with a gloss alkyd enamel. Cutting edges on the hatchets were hand-honed on a series of water stones used for woodworking tools. We completed each tool by fitting a hickory handle (3) through the cavity in the head.

THE TOOLS

Various hammer and hatchet heads, rusted all to hell. Provenance unknown. You achieve an economy of scale when you restore tools in small batches.



1

2



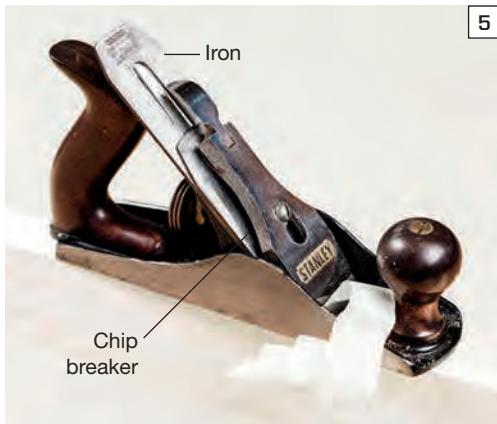
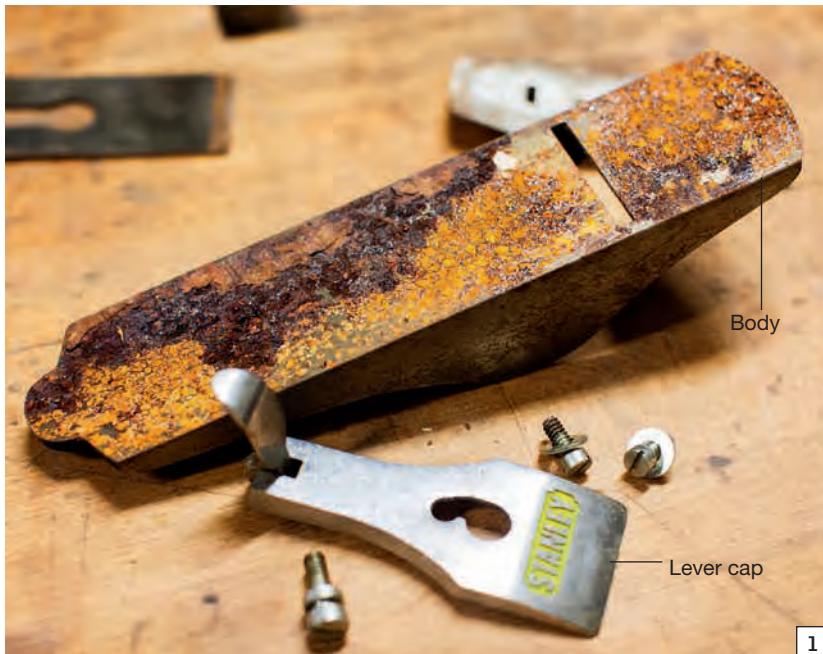
3



THE EQUIPMENT

White vinegar, No. 1 steel wool, rubber gloves, disc sander, hand files for sharpening, mineral spirits, water stones.

Tool restoration clinic



THE TOOL
Stanley hand plane, circa 1960s.

THE EQUIPMENT
Wire brush, sandpaper, mineral spirits, wet polishing wheel, muslin buffering wheel with polishing compound, water stones.

Target: DULL PRECISION TOOLS

Hand planes, machinist's squares, and adjustable combination squares are precision tools that require careful – okay, fussy – restoration and adjustment.

Begin restoring any precision tool with a careful disassembly, separating corroded parts from the clean ones (1). In the case of the smooth plane pictured above, the body was not as badly corroded as it looked. We removed most of the rust with a hand wire brush. Then we lapped the sole of the plane on a succession of abrasive papers, beginning with

60-grit and proceeding through 1 000-grit. We taped the paper to a workbench that has a dead-flat laminate surface and slid the plane body over the paper, swapping it end for end every six passes. We used a few drops of odourless mineral spirits as our cutting lubricant. The body came out flat and smooth, with only minor pitting.

Next we sharpened the plane iron on a horizontal wet sharpening wheel and even honed its back surface so that it was flat several centimetres behind the cutting edge (2). This ensures that the chip breaker will tightly mount to it and not allow wood shavings to be trapped and torn off.

After sharpening, we took the lever cap and the plane iron's chip breaker and buffed them out on a muslin buffering wheel with jewellers' red rouge polishing compound (3).

Romanski has more than 40 years of woodworking experience, so he did the final inspection of the plane iron (4). He followed the machine honing with a careful trip over his water stones, leaving the plane iron with a mirror finish. He assembled and adjusted the plane and took it for a test drive on a piece of clear white pine. The result was a tool that cuts perfectly, taking long, silky-smooth shavings with every pass (5).

THE ART OF THE LOOP

A simple guide to a complicated thing: layering instruments and sounds over each other to create music. **BY KAWEHI**

I'VE ALWAYS BEEN MUSICAL. My grandpa even had a nickname for me as a kid: lekio. It means radio in Hawaiian. At first it was keyboards. I always joke that, as an Asian kid raised by Asian parents, it was either violin or piano, and piano was less boring to me. I started writing music soon after, and eventually I picked up guitar. I moved to Los Angeles to be a singer-songwriter, but I was like every other female musician with an acoustic guitar. I wanted to do something different, so I learnt to loop.

My first looper was a tiny two-track called the Boss RC-30. I went into the garage to learn how to use it, and I sucked. My timing was terrible. That's the most important part of looping. If one thing is off, everything is off, and you're left with a big pile of noise. But by the end of the week I had my timing down. From there, I was addicted.

You need a speaker, a mic, and a loop station, a machine that records sounds, which you can vary in pitch and tempo and play back through an assortment of effects. A two-track loop station (they go up to five) like the RC-30, which'll cost you (R3 000), is good for beginners. Tracks are different sections, A and B, you can record. You switch between them using a pedal. I always set the verse as A and the chorus as B.

Drums are really the foundation. You could use the real instruments, but a keyboard is the easiest route. Or you could even try beatboxing. After I layer the drums, I put on bass – one layer for the chorus and a different one for the verse. With those elements, you have a foundation for the entire song. From there you can play along with a guitar or sing.

OUR EXPERT

Kawehi (no last name, just Kawehi) is a bit of a phenomenon. Her YouTube videos – in which she uses nothing other than her voice, occasionally a guitar, and a looping machine to record covers and original music – have been viewed millions of times each. You can find out about upcoming shows, support her next album, or just check out some songs (her cover of Britney Spears's "Criminal" is a good tutorial in building a track) at kawehi.com.



TIP!

There is a metronome built into many loopers that helps you keep time. Use it. Timing is the most important thing about looping. One millisecond off and you're starting over.

PHOTOGRAPH BY ANDREW ECCLIS

THE NEW OLD TAPE MEASURE

What the heck is a story pole?

BY DAVID OWEN

A COUPLE OF YEARS AFTER my wife and I bought our house, I gutted an unused room and turned it into an office. The project was highly educational, in the sense that by the time it was finished I possessed many skills I ought to have had before I began. Even so, the office turned out pretty well, and in the course of building it I became the owner of virtually every kind of power tool.

I also acquired quite a few analogue tools – including story poles, which I'd learned about from a carpenter friend. A story pole is a homemade measuring rod on which the only markings are ones you make yourself, specifically for the job at hand. For many projects a story pole is easier to manipulate than a tape or a fold-up ruler, and because it contains no extraneous information it acts as a check against careless errors.

To create mine, I squared off the ends of several long pieces of 25 x 50 mm pine, then marked each one with labelled lines representing the critical dimensions of the cabinetry I was planning to build and install in the office: lengths, widths, depths, spacings. Once I'd done that, I didn't need to remember that the bookcases on the north wall were going to be 290 mm deep; I just had to find the depth line on my north-bookcase story pole, then transfer that mark to a sheet of plywood and make my cuts. I also never had to rest an elbow on my tape measure to keep it from whipping back into itself as I groped for a pencil. A story pole is rigid, and if you need both hands you can clamp or tack it in place.

Story poles, in one form or another, have helped builders of all kinds for aeons. Ancient Egyptians used them in constructing the pyramids. Eighteenth-century house framers used them to keep track of ceiling-joint heights (hence the name). Bricklayers, stonemasons and roof



SKILLS

REMODELING

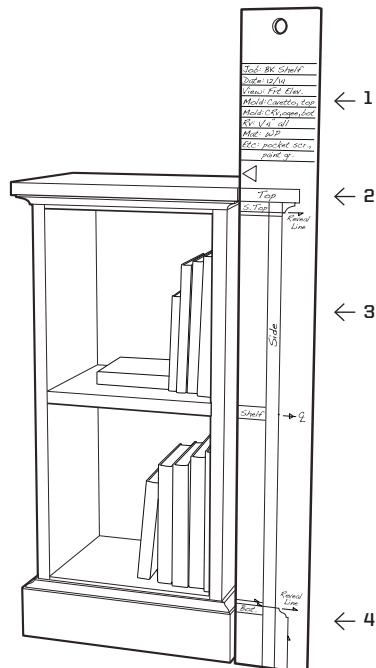
4,5 cm

2,5 cm

tilers still use them to maintain the spacing of their courses. Electricians use them to position outlets, fixtures and switches. My house is so old that it contains almost no level surfaces or right angles; to orient my office bookcases, cabinets, and desk, I used a spirit level to draw a reference line at countertop height all the way around the room, like an artificial horizon, then used a story pole to position elements above and below it. I've even used a story pole to hang pictures.

Story poles are easy to make, but if you prefer tape measures, compromises are available. Lee Valley, a wood-working supply company, sells blank tape measures called Precision Story Tapes: you can make your own marks on them with an indelible pen and end up with a permanent dimensional record of each job. FastCap, another wood-working supplier, sells hybrid tapes that have conventional English or metric markings on one edge but give you a strip of white space on the other for erasable pencil notations of your own. Each FastCap tape measure even has a built-in pencil sharpener – a feature still missing from the rest of my high-tech tools.

Every story pole is a map. This one is for a bookcase. It includes: a data block with information about the project (1), the location of the bookshelf top (2), information about the body (3), and the bookshelf base detail (4).



HOW TO TRANSMIT THE INTERNET THROUGH OUTLETS

A THING YOU SHOULD KNOW



Even if your Internet came into your home at the speed of light, your Wi-Fi network would still create a choke point when everyone in the family is online simulta-

neously. To solve this, you can bypass Wi-Fi entirely and use your electrical wiring like an enormous Ethernet cable. You'll need a pair of power-line adaptors.

D-Link and Netgear sets cost a few hundred rand. One adaptor plugs in to your router and a wall socket; the other plugs in to a socket and the device. This creates a

new, unshared data channel for each Internet-enabled item, which means you'll have only one thing to blame for losing in *Call of Duty*: your aim. – CAMERON JOHNSON

SKILLS



ASK ROY

POPULAR MECHANICS' senior home editor solves your most pressing problems. **BY ROY BERENDSOHN**

If I'm not there to remind him, my son won't wear his safety glasses when working in our garage workshop. I've tried both bribes and punishment. I even showed him a picture of an eye injury I found on the Web. Nothing works. He says he just forgets. Any ideas?

Behaviour modification isn't my strong suit, but I think I can help. First, make sure your son's glasses are comfortable and fit him well. You might even take him to the store and let him pick out a pair he likes. If fit isn't an issue, maybe his glasses fog easily. You could buy a fog-resistant model such as those made by Uvex. You could also treat the glasses with anti-fog solutions that leaves behind a film.

Then, of course, there's the cool factor. You may just have a stubborn, budding fashion lover on your hands. And I know just the thing for him: the old-school safety glasses I grew up with have begun reappearing lately in fancy home-improvement catalogs and online stores. The new ones have a dash of steampunk geekiness that the kids seem to like, but they are

absurdly expensive. Instead, you can buy original horn-rim safety glasses with wire-cup side shields, which is much cheaper than eye surgery.

I seem to have caulked the kitchen-counter backsplash poorly. Less than a year later, some of the silicone is peeling away. What did I do wrong?

Probably several things. First, silicone, glue, and paint have one thing in common: they stick best to a clean, dry surface. In the kitchen you need to clean with a degreaser before applying silicone.

You may also have chosen the wrong product. Silicone comes in any number of formulations. In your case, you should have used a high-quality silicone labelled for kitchen and bath. And you should have made sure it stayed dry as it cured. The manufacturer specifies the necessary time, but it's typically about three hours.

Since you'll be recaulking anyway, here's how to do it neatly: cut away the old silicone with a utility knife and a brand-new blade. Use a painter's tool (a putty knife with a hook-shaped blade) to rake out any remaining silicone. Next, snip the end of the silicone tube so it produces as small an opening as possible that will let a thin but steady stream of caulk through, no larger than about 5 mm diameter. Place the tube in a contractor-grade silicone gun and apply the caulk in as straight a line as possible.

We have a prefabricated wood-frame garage sitting on gravel. Its sill plate has completely rotted away, and it has some rotted siding. Should we repair

this, or is the garage a goner?

Fixing this is going to be a big, backbreaking job. It's probably easier to tear down the garage and build a new one with a pressure-treated sill plate.

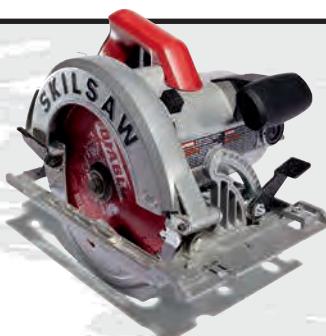
If you're not ready to rebuild just yet, you can extend the life of your current structure for up to five years by adding additional support.

Position a 50 x 200 beam horizontally against each solid wall, at least 75 mm above the garage floor. These should be as long as the wall itself. Using hot-dipped galvanised lag screws, fasten each board to the studs, making sure you're sinking into solid, rot-free wood. As you add screws across the face of the board, make as much of a zigzag pattern as you can. This will create additional stability.

After a frigid Highveld winter, my lawn looks terrible until about the middle of November. Please help.

Sorry to be the one to tell you this, but it sounds like you blew it for this year. The way to get a lawn to bounce back in the spring is to fertilise it in the autumn. Fertilisers for this purpose are labelled autumn fertiliser or winteriser. The nitrogen in these fertilisers helps the grass store carbohydrates so that it will grow quickly when the sun returns. The potassium improves the grass's resistance to cold. Turf pros call this cold hardiness. You can drop that phrase at your next cocktail party.

Now for the good news: you still have time to apply a spring fertiliser or a combination fertiliser with pre-emergent herbicide, such as Frontier Optima. It could gain you a few weeks of nice grass, at least.



WHAT'S IN
ROY'S
GARAGE?

Our columnist
on his favourite
new tool.

What's great about buying a saw from a legacy tool company like Skil is that you know what you're getting: a sturdy, comfortable tool from a company that's proved itself for more than ninety years. So it is not surprising that Skil's newest circular saw, the SPT67WM-22, is solid, agile and vibration-free, with a sidewinder construction and a magnesium motor housing and shoe. It's more surprising that it has a heck of a lot of new design flourishes, including industrial-looking motor vents and ribbing reminiscent of the company's flagship, the Model 77, which was introduced back in the 1930s. It's never a good idea to sacrifice substance for style, but in this case, you can have both.

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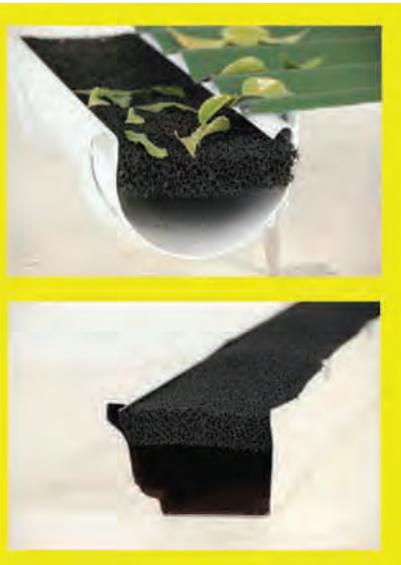


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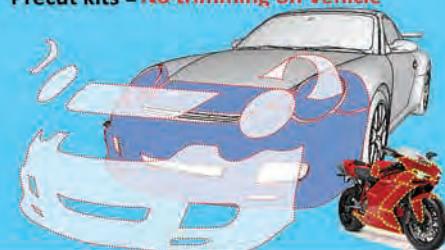
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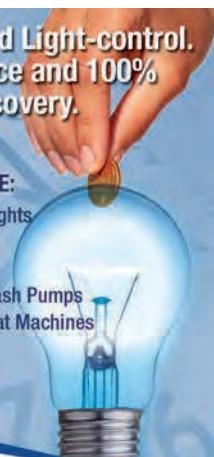


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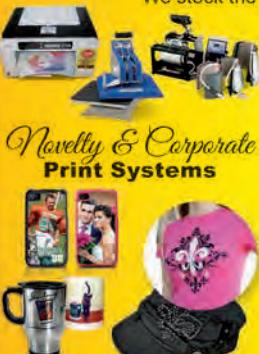


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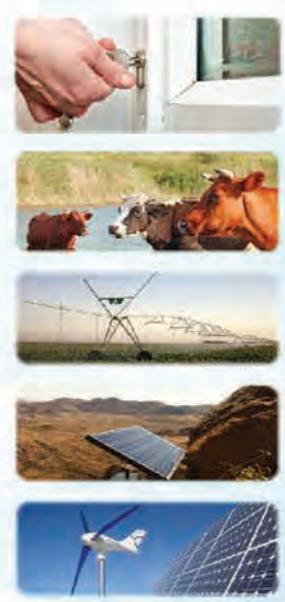
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WINNING TIP

CRIMEBUSTER

Unfortunately crime is a huge problem in our country, even in the outlying areas. I live on a farm and usually leave the office door wide open. As laptops are always in demand, I would be taking a risk simply leaving mine on my desk, but it's a hassle to have to lock it in a cupboard if you only need to go out for a couple of minutes.

My solution is L-shaped brackets screwed underneath the desk. The metal is covered with felt to prevent scratches to the laptop.

So now I sit in my chair, just slip the laptop below the desk before leaving office and there is a good chance it will still be there on my return.

Most thieves will open the drawers, but will not look underneath a desktop.

Hopefully this idea will prevent the loss of some of those special family photos on the laptop that we never back up to a more secure location.

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pressure when one stops the sprayer flow (which is inevitable while washing the car or watering pot plants scattered around the stoep). Simply wrap a few layers of insulation tape around the end of the hose-pipe (just three to four layers is sufficient) before installing the connector.

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with aerosol contact glue should solve the problem. This will not hamper future work under the dashboard; contact glue stays flexible and is also non-conductive. The layer of glue is but a few microns thick.

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Small torque

This hint comes from personal experience and a sprained wrist.

Modern battery-powered drill/drivers, especially the 18 V type, can generate impressive torque, with adjustable settings to suit whatever you're driving. Driving screws into wood is fairly straightforward, as high torque will either be absorbed by the screw-head compressing the wood or strip the thread (not that that is a desirable outcome...). In any case, you would probably have both hands on the drill.

But be careful when using the tool with a nut-driver/socket, especially if (as I did) have to hold the bolt head with a separate spanner and have only one hand holding the tool; when the nut is tight it stops DEAD, and the drill will twist violently in your hand. So always use a low torque setting in such instances, and do a final tightening-up by hand. (My wrist is much better now.)

CHRIS GRAHAM
RANDBURG **PM**

Pressure-proof

This tip is so simple it's ridiculous, but it works like a charm. One of my pet hates is hosepipe connectors constantly popping off because they can't handle the water

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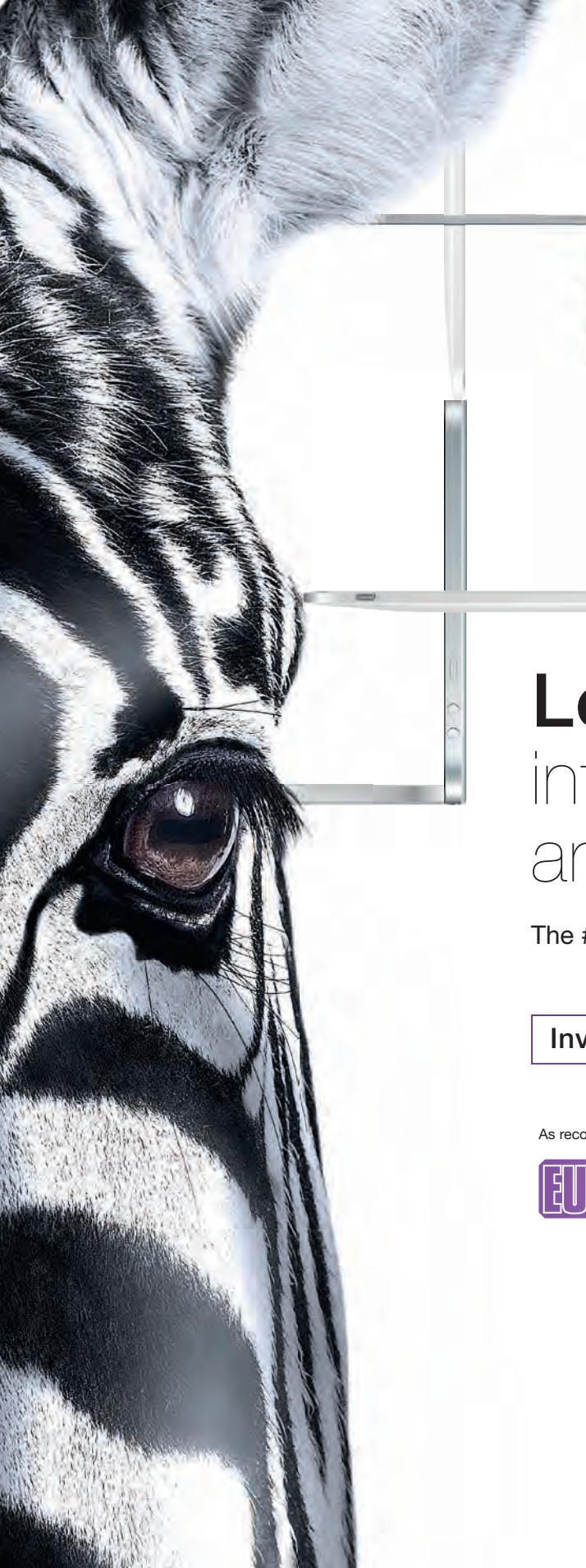


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